

POPULAR SCIENCE

FOUNDED MONTHLY IN 1872

APRIL
15 CENTS

20 CENTS IN CANADA

NOW
15¢

Making Movies in a Volcano

NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS



"I CAN TELL that you're using Ethyl. Stick to it! These days, when we have to do without so many things, I'm telling my customers to make the most of their cars. That's the one thing you can enjoy more than ever—and save money by doing it. Sure, Ethyl costs a bit more by the gallon, but it'll save you a lot of expensive grief.

"I could tell you to go out and buy cheap gasoline and I'd probably be getting some repair work before long. But that's not my way of making friends. What's more, I don't think you'll find any other real mechanic recommending poor stuff.

"Keep right on buying Ethyl Gasoline—pay the few cents more at the pump—and you'll be running this car when some of the others are ready for the heap." Let Ethyl be a life preserver for your car! Ethyl Gasoline Corporation, New York City.



NEXT TIME STOP AT THE

ETHYL PUMP

"You said it—we need a Big Car!"



A CERTIFIED INTERVIEW WITH HARRY D. EDWARDS, Engineer, 76 FINE SEDOK DRIVE, LARCHMONT, N. Y.



"With a gang the size of mine, somebody usually had to stay home. So room in a car was mighty important to us."



"One day we saw a Plymouth ad. The children said: 'That's a swell-looking automobile, Dad. Can't we get one?'"



"When the family saw the new Plymouth, I just had to buy it. But the low price and the trade-in made it easy."



"Now we're all very happy. The car rides like a million dollars. I wouldn't buy any new car without Floating Power."

"We picked Plymouth because it's so BIG in Size . . . and Value"

MAYBE you haven't got a big family like Harry D. Edwards, but you certainly want room in your car.

You can't have real riding comfort if you're cramped for space . . . or, for that matter, if you're annoyed by the vibration of the engine.

We find that people who want comfort . . . who want to relax . . . who want driving to be real fun . . . are picking the new Plymouth Six. Because it's a roomy, full-sized car . . . and because it's the only low-priced Six that is free of all vibration.

Remember that Plymouth alone of "All Three" has Floating Power engine mountings! Not merely rubber

engine cushions, but a *patent* that eliminates vibration.

What do people think of it? Ask Mr. Edwards. He's an engineer. He says: "In my opinion, any car is behind-the-times without Floating Power! Or, in fact, without Hydraulic Brakes or a safety-steel body!"

Ask your dealer for a Floating Power ride. Also ride in the other two low-priced cars. Then decide!

NEW PRICES — 4-DOOR SEDAN NOW \$90 LESS

Four-Door Sedan \$545, Convertible Coupe \$565, Rumble Seat Coupe, \$525, Business Coupe \$495. All prices f. o. b. factory. Convenient payments. Low delivered prices. Closed cars wired for Philco-Trautone radio. Automatic Clutch optional—\$8.

PLYMOUTH SIX \$495

AND UP F. O. B. FACTORY • SOLD BY 7,232
DESOTO, DODGE AND CHRYSLER DEALERS

RAYMOND J. BROWN, Editor
ARTHUR WAKELING, Home Workshop Editor
ALDEN P. ARMAGNAC, Associate Editor
SYBRET OXHORPE, Arts Editor

POPULAR SCIENCE

SCIENCE MONTHLY

VOLUME 122 - NUMBER 4
15 Cents a Copy • \$1.50 a Year
Published Monthly by
Popular Science Publishing Co., Inc.,
301 Fourth Ave., New York

TABLE of CONTENTS for APRIL, 1933

800 Feet on a Fireproof Rope Inside a Flaming Volcano 11

ARPAD KIRNER, French explorer, tells the story of a daredevil exploit for science

Strange Clues Tell Secrets of Man's Life 20,000 Years Ago 14

MICHEL MOK shows you how master detectives piece together fascinating tales of the past

Prehistoric Animals Roar and Hiss for Sound Films 20

A backstage view with ANDREW R. BOONE of one of movieland's strongest feats

Swift Motor Trucks Put Circus Back on Roads 30

EARL CHAPIN MAY tells how modern methods of transportation bring the big tops to town

Vital Organs Cut from Body to Work Life Saving Miracles 32

Extraordinary feats of modern surgeons related by FREDERIC DAMRAU, M.D.

Learn to Know the Stars with an Umbrella 38

GAVLORD JOHNSON explains an ingenious new way to study the heavens

Glow Lamps for Home Lighting 40

Looking ahead with ALDEN P. ARMAGNAC to a new kind of electric light

Living Germs from Other Worlds Brought to Earth by Meteors 42

ROBERT E. MARTIN tells of an amazing discovery that gives evidence of life outside our planet

April, 1933, Vol. 122, No. 4.
Popular Science Monthly is published monthly at 451 Park Avenue,
New York, N. Y., by the
Popular Science Publishing Co.,
Inc., A. L. Tice, President and
General Manager; R. C. Wilson, Vice
President; John Nichols, Vice
President; F. W. Drane, Secy.;
Entered as second-class matter
Dec. 28, 1915, at the Post Office
at New York under the act of
March 3, 1893, additional entry
as second-class matter at Boston,
Mass. Entered as second-class mat-
ter at the Post Office Department,
Montreal, Quebec, Canada. Printed in U. S. A.
Copyright, 1933, by the Popular
Science Publishing Co., Inc. Single
copy, 15 cents (20 cents in
Canada); yearly subscription in
United States and its possessions,
\$1.50; foreign countries, \$1.75;
Ottawa, Canada, 50¢. Subscribers must
notify us of change of address four
weeks in advance of the next pub-
lication date. Be sure to give
both old and new address. The
contents of this publication must not
be reprinted without permission.
The editors are not responsible
for unsolicited contributions, and
cannot guarantee the return of
such material or insure against
its loss. Contributions not accom-
panied by sufficient postage will
not be returned. In presenting
numerous stories of new products
of applied science, Popular Science
Monthly does not endorse
the business methods of the indi-
viduals or concerns projecting them.
The use of Popular Science
Monthly articles for work selling
schemes is never authorized.

FEATURES AND DEPARTMENTS

- Our Readers Say— 8
How to Take Photomicrographs 48
Experiments with Colloids 56
New Home Conveniences 58
Building an Electric Organ 61
Adding a "Mike" to Your Set 62
New Tube Has No Filament 63
Choosing Spark Plugs 64
The Home Workshop 65
"Charcoal" Camera Portraits 78
Ideas for Motorists 84

Cover Design by EDGAR E. WITTMACK

AUTOMOBILES

- Plug Mends Puncture 25
New Window Aids Signaling 36
Wheel Hooke Trailer to Auto 41
Secret Switch Locks Car 47
Truck and Tractor in One 50

AVIATION

- Magnetic Fuel Valve Ends Fires 16
Paddle Wheel Airplanes Next 43
Aerial Garage Rushes Aid 45
Test Tank for Everest Flight 47
Teach Flyers Gunnery on Ground 51
Dial Cells Pilot on Phone 52
Cargo Plane Lands Easy 52
Air Maps on Short Notice 55

POPULAR SCIENCE MONTHLY for APRIL, 1933

ENGINEERING

- Skyscrapers Get Quake Test . . . 16
- Model Mine Is Classroom . . . 12
- Bridge Floor of Steel Mesh . . . 19
- Vibrator Helps Build Bridge . . . 22
- How Our Skyscrapers Evolved . . . 23
- Taking Hum Out of Motors . . . 23
- Bury Phone Poles in Tests . . . 26
- Mechanical Hands Splice Wires . . . 36

MODELS

- Build Miniature Trolley Line . . . 22
- Gears Make Tree Model Grow . . . 21
- City in Hospital Seen in Model . . . 25
- Builds Model of Diver . . . 41
- Toys Fix Home for Wrecks . . . 50
- Models Aid Crystal Study . . . 53
- Modeling the Galileo Rover . . . 65
- A Striking Autogiro Model . . . 72
- Pocket Eraser Polishes Tin . . . 80
- Signal Towers for Railway . . . 86
- Operating Trains on Grades . . . 86
- Lights for Observation Cars . . . 87
- "Doping" Models with Shellac . . . 87
- Cords Work Railway Switches . . . 100

NEW PROCESSES AND INVENTIONS

- Nine Thermometers in One . . . 18
- Loudspeaker Bell Chimes . . . 18
- New Host for Water Polo . . . 19
- Reading Glass Held by Stand . . . 19
- Two Nail Sets Combined . . . 19
- Ink in Bar Form . . . 23
- Naval Putter for Gullies . . . 23
- New Type of Air Battery . . . 25
- Self-Locking Copper Pin . . . 36
- Mount Runs Mechanical Horse . . . 46
- Device Gages Illumination . . . 47

- New Shoe Has Coil Springs . . . 47
- Periscope Guards Bank Vault . . . 50
- New Motor Rolled to Work . . . 51
- Rubber Battery Funnel . . . 52
- Gages Train's Gain in Speed . . . 52
- Machine Marks Exam Papers . . . 53
- Slapper Replaces Cop's Club . . . 53
- New Bullet-Proof Shield . . . 54
- Versatile Putty Knife . . . 55

UNUSUAL FACTS AND IDEAS

- Grow Oysters in Paper Tubes . . . 16
- New Glue Comes in Sheets . . . 16
- Study Bombs for Clues . . . 17
- Speedometer for Fastest Train . . . 17
- Light Throws Time on Sky . . . 18
- Seesaw Starts Stopped Heart . . . 19
- Sailor Makes Own Instruments . . . 21
- Insects Act in Odd Movie . . . 23
- Moving Gangway for Travelers . . . 24
- Marvels of Mosaic Craft . . . 26
- How They Make Jig Saw Puzzles . . . 29
- Ants Run Midget Coal Mines . . . 35
- Synthetic Pasture Feeds Cattle . . . 36
- Music Carried by Light Beam . . . 37
- Sand Blast Leaves Wood . . . 41
- Pendulum Tests Metal Hardness . . . 41
- Cometman in Diving Bell . . . 46
- A One-Man Railway . . . 46
- Old Building Gets Umbrella . . . 46
- Automatic Office Secretary . . . 47
- Lighter Guards Oil Field . . . 50
- Green Island Floats . . . 50
- Robot Stage Prize Fight . . . 51
- Locomotive for 145-Mile Speed . . . 52
- Instruments Help Plan Houses . . . 53
- Metals That Vaporize . . . 54
- Three Faces on One Portrait . . . 54
- When Natural Laws Look Wrong . . . 60

FOR THE HOME OWNER

- Repairing an Old Wringer . . . 68
- Decorating Easter Eggs . . . 77
- Rigging Basement Clothesline . . . 80
- Siphoning Water from Cellar . . . 86

CRAFTWORK

- Wood Carving for Beginners . . . 73
- The Square-Knot Tie . . . 75
- Ash Trays Spun from Metal . . . 76
- Double-Duty Candlestick . . . 90

WOODWORKING

- Our Construction Kit . . . 88
- Home Workshop Blueprints . . . 92
- Little Tables Nest Together . . . 94

IDEAS FOR THE HANDY MAN

- Funnel Holder Flashlight . . . 68
- Dogs from Pipe Cleaners . . . 68
- Mounted Toy Plane . . . 68
- How to Keep Paintbrushes . . . 69
- Bix Protects Circular Saws . . . 69
- Novel Easter Egg Holder . . . 69
- Plating with Zinc-Cadmium . . . 82
- Support for Baby Plants . . . 95
- Amusing Novelties on Lathe . . . 96
- Making Waxed Harness Thread . . . 99
- Machinist Game Simple to Make . . . 101

HINTS FOR THE MECHANIC

- A Portable Air Compressor . . . 70
- A Low-Cost Spot-Welder . . . 80
- Setting a Surface Gage . . . 80
- A Twin Point Scriber . . . 100

In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

Swiftly - Safely the Wonderful **SIMONIZ** **KLEENER**



MAKES CARS SPARKLE LIKE NEW

Restore your car's original beauty this easy, scientific way! A few easy strokes with Simoniz Kleener on a dry cloth and all grime, traffic film and discoloration vanish! Then apply Simoniz for lasting beauty and all-weather protection. Simoniz positively makes the finish last longer and keeps the colors from fading.

REMOVES STAINS FROM WOODWORK

Simoniz your furniture and woodwork, too! The Kleener removes dirt, stains and blemishes in a jiffy. And Simoniz provides a hard, dry surface of protection that makes the finish stay beautiful. Just wiping occasionally with a dry cloth keeps it clean.

CLEANS GLASS
LIKE MAGIC
Nothing could be quicker or easier than Simoniz Kleener for cleaning windows of your home or car. Just put it on with a damp cloth, let it dry and wipe off. The glass will be crystal-clear and free from smears.

TAKES TARNISH OFF SILVERWARE

Simoniz Kleener on a dry cloth is the safer, easier way to clean silverware, pewter, brass fixtures or any dulled or tarnished surface!

MOTORISTS WISE SIMONIZ

RELIEF PROMISED BY NEW Bankruptcy Bill

By LEON MEADOW, *Financial Editor*

A NEW Bankruptcy Bill is now up before Congress, and, should it become a law, its provisions should interest almost every one. Not only does this bill provide for revised action in the case of bankruptcy but it will also bring a change in foreclosure proceedings on home mortgages.

Under the present bankruptcy laws any creditor can institute bankruptcy proceedings, no matter how small the amount of his particular debt is. The fact that the largest creditors of any man or firm are not ready to take action, or do not wish to, makes no difference. The very fact that new bankruptcy laws have been proposed shows that old laws have finally been recognized as unfair and archaic and that something should be done about them.

Take this example, a railroad company owes its creditors \$100,000 for equipment of various types, and it has a bond issue of \$1,000,000. Those bond-holders are also creditors. Some equipment company, with a bill of \$10,000 decides they have waited long enough. They institute and succeed in obtaining bankruptcy proceedings, over and above the protests of the bondholders and all other creditors, who feel that by waiting they will eventually be paid back more than they will get by immediate bankruptcy. The assets of the railroad are then liquidated under present market values, and the money is paid out proportionately to all creditors.

Under the new law, the following changes take place. The firm or individual who come to the point where they cannot carry on any longer may draw up a list of their liabilities and assets and take it to the nearest Federal Court. For a fee of two dollars, they may give the clerk a statement setting forth their inability to meet obligations. In the course of time the statement and lists are presented to a Federal Judge who, if he believes in the merits and honesty of the case in question, may then turn the whole affair over to an individual known as the referee in bankruptcy.

NOTHING is done after that, until the referee notifies all creditors of the action which has been taken by the debtor, and invites them to attend a meeting in which the matter of relief will be discussed. The debtor must be present, and come prepared to answer any questions on his financial affairs which the creditors may wish to ask.

There are two courses of action open to the debtor. He can propose scaling down all debts to a level which he feels

he can maintain, or he can suggest deferring all attempts at immediate collection, in the hope that such a breathing spell will give him time to resume his obligations at some future date.

If the first alternative is accepted by the creditors, it then remains with the referee to arrive at some basis of readjusted payments which will be fair and acceptable to all parties concerned. On the other hand, should the creditors turn down the first proposal, then a different procedure follows. The debtor must bring the creditors to a point of agreement on the subject of a collection extension—or a moratorium, not unlike the one extended to Germany in 1931. If he succeeds in obtaining that, the agreement is presented to the referee for approval. When, and if approved, the settlement becomes binding on all creditors, including any who might have objected to the proposal when originally offered.

In fairness to the creditors, the new bill will permit them to demand some part of their debts under the extension agreement. If it is decided that the debtor shall pay, he must do so. And the payments would have to be accepted by those who might not have agreed to the settlement, as well as those who did.

SO MUCH for the bankruptcy law. Now we come to another side of the picture, one that is perhaps of even greater interest to most people in the country today. And that is the matter of foreclosures on homes and commercial properties. Under the present laws (which vary in different states) foreclosure proceedings may be instituted within thirty or sixty or ninety days (depending on the state law) after default of mortgage principal, mortgage interest and tax payments.

Under the new bill, if it becomes law, the man who is faced with losing his home or property may file his case with a clerk of the Federal Court. By so doing he is in a position to ask for an immediate suspension of foreclosure proceedings. When the case is presented to a Federal Judge he may issue an order forbidding foreclosure proceedings, or he may refuse to issue such an order. It would depend entirely on the circumstances of the case, and on any plan which the mortgagor might present for paying off tax arrears, and perhaps for a small monthly amount on the balance, including mortgage.

That finishes the discussion of differences between the old and proposed new bankruptcy laws. As far as bankruptcy is concerned, both debtors and creditors are bound to (Continued on page 5)

RELIEF PROMISED BY NEW BANKRUPTCY BILL

(Continued from page 4)

receive a better "break" if the new bill goes through.

The mortgage situation is a little more complex. A mortgage holder lends his money on the supposition that the man who wants the mortgage is in a position to pay his debt, or the interest on it. In the case of the mortgagee, he assumes the debt not because he has to, but because by so doing he feels that he will be able to purchase something he wants and is willing to pay for. That being the case, one's first impression is that the new bill may be a little hard on the mortgage holder. In actuality, it is hoped that the new bill will aid him. The very fact that it will make possible the suspension of foreclosure proceedings is, in emergency times like these, a step in the right direction. For, if there is no such measure, it is highly possible that the courts of the country might be flooded with foreclosure proceedings. Whole areas might be affected by them. And what would then set in would be a wholesale depression of realty values. This would result in the inability of many mortgage holders to regain their original loan, because of the fact that the sale price of houses under such conditions would not even cover the first mortgage.

Obviously, mortgage holders are showing a keen interest in this new bill. One of the things they want to know is whether or not the courts can scale down their mortgage claims without their consent and, also, whether or not the courts have authority to defer interest payments on mortgages without their consent. The answer to both questions is no—they have not. And the reason is that Congress is fearful of the constitutionality of any law which goes further than temporarily preventing mortgage holders from foreclosing on property. Consequently, the bill at present carries no provision which would permit the courts to scale down a mortgage without consent of the holder. All the authority the courts have is to suspend foreclosure proceedings and interest payments.

ONE of the questions that has been raised most frequently to date in regard to this new bankruptcy bill is its length of life. How long will these moratoriums and foreclosure suspensions last? The answer is that nobody knows; not even the sponsors themselves can tell. Beyond the evident fact that the bill is of an emergency character and, therefore, necessarily a temporary affair, nothing is known about how long it will continue to operate, if it is passed. As for the length of the moratoriums—they will depend entirely on the court's interpretation of individual cases. Mr. Jones may get a year's breathing spell; Mr. Smith may be awarded five years, all according to the judgment of the court and the circumstances brought before it. There is no provision for any sort of fixed terms to be imposed on one and all alike. Each case will be settled on its own merits. Limitations, as well (Continued on page 6)

THE NEW 10★ GENERAL ELECTRIC

"The ONE outstanding feature in Refrigeration"



"TEN STAR FEATURES!"

- * New Monitor Top—stainless beauty with smooth walls. Famous "on-top" sealed-in-ice mechanism.
- * New All-Steel Cabinet, porcelain inside and out. Sturdy, modern, styled for the years.
- * New Sliding Shelves. Adjustable in height. More usable storage space. Shelves slide out of finger's touch.
- * New Stainless Steel Freezing Chamber. Cannot chip or rust.冻 more ice faster. Open, sanitary, no food odors. Easier cleaned.
- * New Semi-Automatic Temperature Control for fast or slow freezing. Equipped with new G-Edefrost Refrigeration system.
- * New Automatic Interior Lighting. When door opens, interior is flooded with light.
- * New Foot-Pedal Door Opener. Door swings open at touch of toe on floor pedal.
- * New Hardware with Semi-Contoured Wings. Chromium finish. Won't scratch. Fingerprint proof.
- * Completely Equipped with Food Containers of covered glass, Chiller Tray, and Vegetable Pan.
- * Carries the Unparalleled 4-YEAR SERVICE PLAN of General Electric... world's largest electrical manufacturer.



AGAIN General Electric sets new standards in electric refrigeration! New beauty—new styling—new features—more value per dollar. The new 10★ G-E freezes more ice faster—consumes less current—operates so quietly you scarcely hear it. New all-steel cabinets are gleaming porcelain inside and out—beautifully modern in design. See them at the G-E dealer's.

* No other mechanism has matched the Monitor Top record for dependable, trouble-free service. Within walls of ageless steel every moving part is sealed against air, dirt, moisture; safe from neglect or abuse; requiring no attention, not even oiling. * 1 out of 3 electric refrigerators in use today is a G-E Monitor Top.

There's a General Electric model, size and price to exactly meet your requirements. Terms as low as \$7 down and \$7 a month. General Electric Co., Electric Refrigeration Department, Section M-4, Hanna Building, 1400 Euclid Avenue, Cleveland, Ohio.

We urge comparison of the G-E junior with any other flat-top refrigerator carrying a 4-Year Warranty. Prices as low as

\$99 50

Plus Tax and Delivery



MEN be sensible about SHAVING CREAM • 25¢ is enough to pay

Not many years ago, this company bought first-rate materials, pared production cost to the bone and produced a tooth paste at 25¢. Today it is a leader in the field. Its price was appealing, but merit and results gave it this leadership.

Now we're doing the same thing with Listerine Shaving Cream. We've made it as good as a shaving cream can be made. Like the tooth paste, it is winning men by thousands. Also like the tooth paste, its price is 25¢. Anything over that, we think is extravagance.

Here's a satiny cream that will lather in four seconds. In hard water, cold water—even in ice water. That cools and soothes skin and softens the beard so that your shaving is a delight instead of a nuisance.

To produce this shaving lather you use a bit of cream no larger than your little finger nail. The tube seems to last forever.

A quarter isn't much to risk to find out how swift and economical a shave can be. Get a tube today from your druggist. Lambert Pharmacal Company, St. Louis, Mo.

FREE
10 shaves for you
CLIP THIS COUPON NOW—

Lambert Pharmacal Co., Dept. P. S. 4
St. Louis, Mo.

Please send me free trial of Listerine Shaving Cream.

Name _____

Street _____

City _____ State _____

New Bankruptcy Bill

(Continued from page 3)

are dependent upon the facts and the judge in each case. It may be stipulated that no payments on account should be made during the time of suspended action, or the judge may decide that weekly payments or monthly payments are to be made.

THIS flexibility will go a long way toward making the bill a humane, worthwhile piece of legislation, providing, of course, that those empowered to make decisions exercise proper discretion. Naturally, the Courts may make mistakes, and it may go harder with one than with another. But, the only way to avoid this would be to put into the bill such provisions as would eliminate the necessity of leaving decisions to the discretion of the Court. By so doing, few, if

any, would get a fair deal. One rule covering everything would undoubtedly cause more harm than could be effected by improper discretion on the part of those who must judge on individual circumstances.

Because it is bound to affect so many home owners, many Congressmen believe that there will not be enough Federal judges to handle a fraction of the cases that are sure to be initiated once the bill is passed. To prevent any delay that might result from inadequate organization, this law will assign to referees in bankruptcy most of the duties which are assigned to the judges. And the law also provides that enough of these referees shall be appointed in each case to handle claims with the greatest possible speed and efficiency.

TO HELP YOU GET AHEAD

THE booklets listed below will help every family in laying out a financial plan. They will be sent on request.

The Investment Aspect of Life Insurance, by M. A. Linton, presents life insurance as an exceedingly worthwhile investment as well as a form of protection. Provident Mutual Life Insurance Company, of Philadelphia, Pennsylvania, will mail a complimentary copy upon request.

Before 65 and After explains the full details of a Retirement Income, with full Life Insurance, Disability and Double Accident benefits. Sent on request by The Equitable Life Assurance Society, 393 Seventh Avenue, New York City.

How to Get the Things You Want tells how you can use insurance as an

active part of your program for getting ahead financially. Phoenix Mutual Life Insurance Company, 328 Elm Street, Hartford, Conn., will send you this booklet on request.

See How Easy It Is tells how it is possible to start off with a definite plan for creating an immediate estate leading to future financial security. Get your copy of this booklet by writing to Postal Life Insurance Company, 311 Fifth Avenue, New York City.

"You Can Have An Income As Long As You Live," a booklet describing simply and clearly how the Annuity can be used to provide a guaranteed income for life. A copy will be sent on request to Inquiry Bureau, John Hancock Mutual Life Insurance Company, 197 Clarendon St., Boston, Mass.

STRENGTH OF INSURANCE COMPANIES REVEALED BY 1932 STATEMENTS

READERS of Popular Science Monthly who are policy holders in the insurance companies advertising in this magazine should be interested in seeing the 1932 annual statements of these companies. In general, these statements indicate a secure, sound basis of stability, and are a tribute to the wisdom and integrity which insurance companies have used in safeguarding the interests of their policy holders.

We have made arrangements with the Equitable Life Assurance Society,

Phoenix Mutual Life Insurance Company, and Provident Mutual Life Insurance Company for the distribution of their 1932 annual statements to readers of POPULAR SCIENCE MONTHLY.

If you wish to have a copy of any or all of the statements issued by the above companies, simply address your inquiry to the Financial Department Popular Science Monthly, 381 Fourth Ave., New York, N. Y. Your request will be answered promptly.

HOW TO GET STARTED IN THE HOBBY OF SHIP MODEL MAKING

THERE are few hobbies—not even working out picture puzzles—that will give you so many hours of pleasure at so low a cost in the long run as building ship models. Thousands of POPULAR SCIENCE MONTHLY readers have found this true in spite of the fact that they had no previous knowledge of ships or of model making when they started to construct their first model from our plans.

Now, however, we have made it still easier to begin this hobby by providing construction kits of carefully selected materials. You no longer have to do a lot of "shopping around" to get what you want, and it is not necessary to buy excessive quantities of each kind of material or try to make use of unsatisfactory substitutes.

Two kits are especially recommended for beginners. One contains all the raw materials (except glue and paints) for building the beautiful model of the Elizabethan galleon *Revenge* illustrated on pages 5, 66, and 67 of this issue. The materials are listed on page 93, and the kit is further described on page 88. Picturesque as this model is, the construction is not difficult. Do not be deceived by the costly and elaborate appearance of the finished model as it appears in the illustration on page 65. Capt. E. Armitage McCann, who designed it from original historic sources, kept in mind the needs of the beginner at every stage of the construction, and he used all the resources of his many years' experience to simplify the various details, including the rigging, to such a degree that the inexperienced model maker would find the work relatively easy. Each kit is accompanied by four blueprints showing all parts full size. These blueprints alone would cost \$1 if purchased separately.

The second kit that has been designed chiefly for beginners contains the sawed out hull and materials (except paints) for a 12 in. long miniature model of the new American liner *Manhattan*. It is illustrated on page 88. Because it is so very small and simple, the model can be made on the kitchen table—or in the living room, for that matter—with a pocketknife, a safety razor blade, a pair of small-nosed pliers, a file, and, if available, a fret saw or jeweler's saw.

Popular Science Homecraft Guild,
381 Fourth Ave., New York, N. Y.

- Materials for building a 15 in. long model of the gallant *Revenge*, for which I enclose \$6.75 (or \$7.75 with the hull blocks fully shaped).
- Materials for building a 12-in. miniature model of the liner *Manhattan*, for which I enclose \$1.00.

Name _____

Address _____

City _____ State _____
(Print very clearly)

Note: The *Revenge* kit is 30 cents higher west of the Mississippi River because of heavy shipping charges. If desired C. O. D., there will be an extra charge of 24 cents. The *Manhattan* kit is not sent C. O. D.

Now—a book on accounting that every man in business can use—

Accountants' Handbook

New
Second
Editions



WHETHER you work on the accounts yourself or use them in business management, the new Accountants' Handbook is the first place to go for help on accounting questions in your business day.

In this great book you will find the information you need to handle any situation you may meet—everyday or emergency—from simple bookkeeping to higher accounting.

An encyclopedia of accounting complete in one handy volume

When you begin to use this Handbook, you extend immediately your accounting ability. For all questions put on your account, modern practice covering the entire range of accounting—principles, procedure, systems, controls, analytical methods, audits, etc.

In dealing with any question, you can select, not merely the usual, but the best method for your purposes. You see all sides, get best opinion on all angles—but only accounting, but banking, legal, financial. When you meet unusual situations outside your personal experience, you are sure to find here the guidance you need.

Every feature designed to save you time

Nowhere else, at any price, is there anything like the Accountants' Handbook. It brings together vital information you might otherwise have to seek out in hundreds of sources. Concentrated in the 1913 pages of material equivalent to forty-five of usual style, or 100 loose volumes. Tables, rules, definitions, and formulas abound. 60-page index.

—Sent for 8 Days' Examination—

You risk nothing, no advance payment. The Handbook will be stamped on approval. If it isn't what you want, send it back. Money payment if you wish.

Special Offer for Limited Time Only:

A Useful Pocket Memo Book for Accountants and Financial Men

If you order the Handbook now, we will send with it a handsomely bound pocket memorandum book which contains also many valuable tables, short cuts and checks, and data used in everyday business transactions. This is yours to keep without additional charge if you retain the Handbook. Send the order form at the right—at once.

SEND NO MONEY; USE THIS COUPON NOW



Now
**YOU CAN AFFORD AN
IN BOARD
RUNABOUT
*The Sea Eagle
Scout***

**Only
\$650**
FOR SALE AS IS

Write Today for YOUR Folder Describing
This Year's Inboard Achievement

A BEAUTIFUL BOAT in the 16-foot class—powered with a 45 H. P. Marine Motor, built of puncture-proof galvanized Armco iron plates that never require caulking, equipped with non-sinkable air chambers and complete all ready to operate—the Sea Eagle Scout offers more in value for less money than ever before in inboard history. Let us show what a lot of motor boat you get. Send for the folder!

Every Sportsman, Fisherman and Camper

Every sportsman, camper and fisherman will want to know about the new 32 H. P. Camp Mate, the shallow draft boat with the tunnel protected propeller. And more inboard boats as low as \$12. Just write—we will send you complete literature on the Mullins line.

Write for our demonstrator and area proposition.

MULLINS MANUFACTURING CORPORATION
Boat Division • 20 Mill St. • Salem, Ohio

Editorial Board of
More Than 70 Authorities
Edited by W. A. PATON, Ph.D., C.P.A.

33 Sections Cover:

Financial Statements; Statement Analysis; Account Classification; Cash Investments; Land, Wasting Assets; Buildings, Equipment; Depreciation; Income; Plant Appraisal; Intangibles;

Current Liabilities; Fixed Liabilities; Capital Stock; Margins; Reserves; Joint-ventures; Consolidated Statements; Inventories; Accounting Organization; Inventories; Bad Debts; Etc.

Manufacturing Costs; Distribution Costs; Standard Costs; Systems; Standard Methods; Public Accounting; Inventory Accounting; Business Law; Mathematics; Double-Entry Principles
1873 pp.; Flexible Binding; \$7.00

TOTAL ISSUE OVER 100,000 COPIES

THE RONALD PRESS COMPANY

15 East 26th Street, New York, N. Y.

Send me postpaid, in exchange with your special offer, a copy of the Second Edition of the Accountants' Handbook together with the pocket memorandum book. Within five days after the receipt, I will send you \$7.00 in full payment for the Handbook alone, or return both books to you.

Check here if you prefer to pay for the Handbook in 8 monthly payments of \$0.50 each

Name _____

Firm or
Organization _____

Residence Address _____

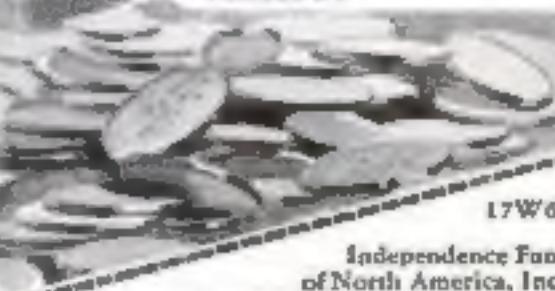
City _____ State _____ ZIP CODE _____

Check here if this is not accompanied by cash



Constructive THRIFT

Independence Fund presents a new thrift program. All payments go directly to a Trust Company, which acts as your trustee according to the terms of your Trust Certificate. If you can afford to put aside as little as \$10 a month, send the coupon for the free booklet, "35 Questions—36 Answers" and learn the advantages of this plan. Independence Fund of North America, Inc., One Cedar St., New York, N. Y.



17W63

Independence Fund
of North America, Inc.,
One Cedar St., New York, N. Y.

Name _____

Street _____

City _____ State _____

Our Readers Say



Wood Turning is Now Mere Child's Play to Him

When I became a subscriber of *POPULAR SCIENCE MONTHLY*, I was interested in wood turning. I had never seen a lathe in operation but I had a half-horsepower motor and a saw table, which I had built, so I decided to get a lathe. A secondhand man told me all the good things about a lathe he had. I hit—and got hit, too. I set it up in my basement, fastened the countershaft to the floor joist, and eventually got it going. It sounded more like a threshing machine than anything I had heard since leaving the prairies, but I supposed that was the nature of it. My wife soon came down and informed me that if I was going to run that thing there she was going to move out; so I decided it would be better to move the lathe. I built a shop then, and out we went. It was necessary to get a two-horsepower motor for the lathe as it was a big one. I found that the countershaft was sprung a quarter of an inch, pulleys were out of balance, and one box was worn out. After building it over a few times, I finally made a lathe out of it and can now turn like nobody's business. In fact, I have a profitable business turning out novelties on my lathe. I only work at the turning in my spare time, mostly evenings. For light I took two old car headlights, cut a hole in the back of each large enough to get in a chain pull socket, and put forty watt bulbs in them. I have one directly above the face plate and one to the right and in line with center of face plate. Both lights are adjustable, and can be turned to any part of my work or any part of the shop. I was depending entirely upon you for all my information about turning. Everybody seemed to come just about as I needed it.—W.J.M., Roseburg, Ore.



But, of Course, the Suggestions Are Always Well Meant

I READ the letters in *Our Readers Say* in each issue, and it amuses me to note the "improvements" they suggest. If you followed everyone's advice you would soon have a good many varieties of reading all published in one magazine—and there is no telling what you could call it. It would have to be some kind of a cross between a ladies' fashion, care of infants, and a fiction book with a little scientific matter thrown in to sort of keep up old traditions. As to my suggestions for improving the magazine, —I have none. I read what I am interested in and I let the rest alone. I wish a few more would do the same thing.—H.K.E., Maple City, Kan.



Here's a Simple Little Change We Are Asked to Arrange

I APPRECIATE very much the text and experiments on chemistry. They are of great help to me. Raymond H. Wailes, sure knows his onions all right. I don't want to criticize the least little bit, but just want to give you my point of view regarding your great magazine. Why not have special space for physics only, biology, and psychology? Something similar to the course in chemistry. A little mathematics, which is also a part of science, would not do any harm. I'm asking you to do this for the simple reason that order is very important in anything we do. If you adopted this plan, we would not have to look through the entire book to find an item in which we are particularly interested. According to *Our Readers Say*, I am not the only one among your readers desiring this chance.—E.A.M., Montreal, Can.

Just a Little More Light on Queer Trade Lingo

Yesterdays article on professional slang was read with interest, especially that part dealing with the talk of electrical linemen. As an electrician, let me add a few examples to an already accurate list. When wires are strung and you tighten them up, you "pull tension." To do this, you fasten the "bow line," or pulling cable, to the winch and connect it to the wire to be pulled by means of a "come-along," or clamp. If it is necessary to go out into mid-span, you "go out on the phase." The "overhead boss" is the line foreman, and the "monkey" is the winch. You "like a pole" when you climb it and you "burn a pole" when you slide down it.—R.M.S., Jr., Burlington, N. J.



Do You Want Puzzles in Your Magazine?

SEVERAL contributors to *Our Readers Say* have suggested that we start a mathematical puzzle department. We are not at all certain that these suggestions actually represent the wishes of any great number of readers. However, we are willing to go halfway with the puzzle fans. We will give them the space for the department if they will fill it, and we will continue it as long as an interest in it is demonstrated. The following conditions, though, must be observed:

1. No contributions will be paid for and none will be returned.
2. Contributions must be puzzles, not problems in test book mathematics.
3. Each problem submitted must be accompanied by a solution.
4. Each contributor must state whether the problem submitted is original, and, if not, from what source it was obtained.

5. We will print the answers to all published problems, but, because of the limitations of space, cannot give detailed solutions.

6. We will enter into no correspondence regarding puzzles, and will neither promote nor aid any correspondence regarding puzzles among readers.

So, puzzle fans, if you want a department under these restrictions, let's hear from you.—THE EDITOR.

Offering a Few Sticklers On the Glue Problem

AMONG other much appreciated articles in your magazine, I have read your articles on gluing and glue joints and I am going to take the liberty of suggesting another article which I think will answer some questions I have often heard asked but never answered from an exact or scientific standpoint, viz: When putting glue to soak what is the increase in volume, if flake or if ground? What proportion of water should be used for soaking? How long should it soak before being placed in the boiling pot? How long should it be cooked to reach its maximum quality? What is the deterioration if cooked longer? What is the ideal consistency and how determined? How, if by any means available to the novice, may good glue be determined from bad?—C.G.A., Corinne, Utah.



Add This to Your List of Freaks of Nature

COSTA RICA has had its own shower of fish. We have found no one as yet who actually saw fish fall, but the fact remains that suddenly there were thousands of small fish, about an inch in length, swimming up the streets, in the lawns, and in tanks and vessels that happened to be in the open. In spite of many casualties, we still have over a dozen live fish in the high school laboratory. Some of these specimens were taken from pools in the lawns, some from a watering trough, and still others were caught on a tennis court. These fish fell Dec. 1, 1931, during the torrential rains at the end of the wet season. New Cristobal, where the fish fell, is 200 to 800 yards from the sea shore. During the rain exceptionally heavy winds were blowing in from the sea. The students were interested in the story about fish rains that ran in *POPULAR SCIENCE MONTHLY* last July. But since we have had a fish shower of our own, these old copies are in great demand again. Consequently some of the students have the information on fish rains well catalogued and will readily talk at some length about them.—J.W.C., San Jose, Costa Rica.



length on such things as the time and place that the baby carp fell inside a nail stone or the Scotch carpenter caught his hat full of fish.—K.W.V., Cristobal, C.Z.

What a Microscope Did For His Razor Blades

SIXTEEN years ago, I saw a small microscope advertised in your magazine and sent for it. My idea was to use it to find a small worm or bug, that spoiled some of my garden stuff. One day I put a discarded safety razor blade under it and discovered the edge turned up in two places. I rubbed it on a strap and found that the turned part was straight out in front of the blade again, so tried it and it worked like a new blade. I then made a wooden contrivance to hold a blade so it could be sharpened like an old style razor and that one blade has shaved me every two days since. I have some sixty old blades on hand and they will last nearly that many years at the rate I am going. I have been shaving nearly nine months with the one blade now and would have had to buy several packages had it not been for the microscope showing me what was wrong. F.A., Peace Rye, Can.



Who Wins When a Snail Battles With a Snake?

M.O.M., of Nashville, Tenn., has a spider problem bothering him. I wonder if he noticed the articles in the papers last summer about the spider in Chicago that entangled its web around the head of a snake, multiplied the strands until they would stand the tensile strain, then lifted half the snake in the air and held him suspended in this manner for three or four weeks until the humane society intervened that the snake be released. Needless to say, the snake was engaged in a hopeless battle and would have died. But how did the spider get the snake in this mess in the first place? Another case has turned up where a man fastened itself to a snake's nose and maintained this grip until the snake died. The forty-five minute struggle was witnessed by many spectators. M.O.M. can find many such cases to puzzle over and I might say that he is doing himself some good in giving thought to these riddles. Spiders, cockroaches, ants, and several other insects will surprise anyone that will observe them carefully. It would have been very interesting to watch the spider stretch a forty-foot web from tree to tree, ten feet above the ground, especially if the earth was covered with tall grass through which it could not drag its web along the ground with it as it went.—A.U. Whitehead, Inc.

Peroxide Gets His Vote for Unhappy Shavers

IT ANSWERS in the city of A.A., New York City for a new, better, pleasanter, and painless shave tube for the stygian pencil now used to stop the flow of blood from razor cuts, here are my suggestions: 1st, Peroxide of hydrogen, full strength (as usually sold) 2nd, The above followed by toilet water perfume etc, 3rd Ether or chloroform. The peroxide will fill all requirements. Buy small sealed bottles and keep from heat and sunlight as the active principle is a gas.—A.B., Coeur d'Alene, Id.



Knockers Make Life Hard for Ambitious Inventors

I HAVE no amateur radio license, but I am keenly interested in radio and hope soon to secure a license. The main purpose of this letter is to ask W.G.W., Martin's Ferry, Ohio, where he thinks radio would be were it not for amateurs? I think just such knockers as he are what makes it hard for any new invention or idea to be introduced to the public. M.C.K., West Allis, Wis.

Man or Bug, Which One Rides Ferris Wheel Faster?

WILL someone answer this for me? A man is riding on a seat on the outside of a Ferris wheel, and a small bug is doing the same on the axis of the same wheel. Now, the question is, which one of the objects moves with the greater speed when the wheel is in motion? J.W., Brinkley, Ark.



Another Reader Disagrees With the Evolutionists

I FIND your magazine very interesting, but I can't get that evolution idea from under my skin. I don't agree with those so-called evolutionists who don't know but seem to know, or think they know that man descended from a mammal. In the first place, there is no record of any man keeping a journal of his condition, nor does he not have one living friend by which they can show that man descended from an animal. According to the evolutionists, man is supposed to be the most highly developed in the animal kingdom, but each member of every class was also once the most highly developed before it evolved into something higher. What I would like to know is *into what will man develop?* We read that man has been on this earth for thousands or even millions of years and he always reproduces man and never develops into something new. It is not necessary to guess or make up different stories about the evolution of man since it is written in the Bible and one cannot doubt that book for it does not guess or lie. As to the evolution of animals and even the earth, that also is sufficiently explained in that Golden Book.—C.C.J., Nanticoke, Pa.



He Finds with Delight, a Round Pail is Right

HERE is the answer to the bucket-making problem in a recent issue. A triangular bucket, ten inches deep, thirteen and one-third inches on each side holds approximately 984 cubic inches. A square bucket, ten inches deep and ten inches on each side holds 1,000 cubic inches. Then the round bucket, ten inches deep, holds approximately 1,271 cubic inches. A round container always holds more than any other shaped container provided the depth remains constant. I am interested in your chemistry feature. I enjoy it but may I suggest a few experiments covering just of the "Kerosene's Rings" phenomenon? These experiments present a spectacular appearance. S.E.W., St. Louis, Mo.

This Unselfish Reader Lands Spirited Kick

POPULAR SCIENCE MONTHLY is certainly a swell magazine, but like all other periodicals it isn't perfect. Still, I won't be selfish and ask for articles of interest only to me. Borden Hall's article on the microscope and Dr.

Darrow's series on modern surgery are absolutely marvelous. Also they help to keep a scientific tone in the magazine. But some of the other things! Please, if we are to have a scientific magazine, cut out the "Auto Stealing" stuff and a few others like that. If you put this in Our Readers Say I'll bet every one will agree with me, especially the auto crooks.—C.M., New York, N.Y.

Elemental Mathematics Will Solve This One!

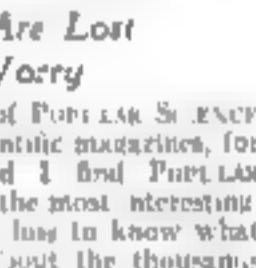
WHILE I agree with G.N.P. of Connecticut, that the problems should be a little harder, yet I think that problems in which use is made of higher mathematics for their solution should not be included. An interesting problem that can be solved by the use of the most elementary arithmetic is this:

A man had a store in which he used only five weights to measure his goods by the pound. That is, he could weigh amounts of one pound, two pounds, three pounds and so on consecutively up to 15 pounds, which was the total sum of the five weights. Thus he could accomplish in a two-pan balance by using one or both of the pangs as would be necessary and weighing the whole amount of the goods at one and the same time.—J.R.G., Rio Piedras, P.R.



Teacher of Science Keeps Popular Science on File

I HAVE been a constant reader of POPULAR SCIENCE MONTHLY for five years, and I don't intend to stop reading it for a long time to come. I have all the copies carefully indexed and filed and value the collection highly. As a teacher of science, mathematics, and manual training, I think POPULAR SCIENCE MONTHLY has no equal as a reference magazine. Also, I get quite a kick out of Our Readers Say features, especially the problems and puzzles presented there.—G.E.B., Worcester, Mass.



Great Ideas That Are Lost Cause Him Real Worry

I HAVE been a reader of POPULAR SCIENCE MONTHLY, and other scientific magazines, for a number of years and I find POPULAR SCIENCE MONTHLY to be the most interesting. However, I am still at a loss to know what science is going to do about the thousands of valuable thoughts and ideas originated by people who are not financially able to experiment and develop them and who die with their ideas still a secret.—E.G.T., Anniston, Ala.

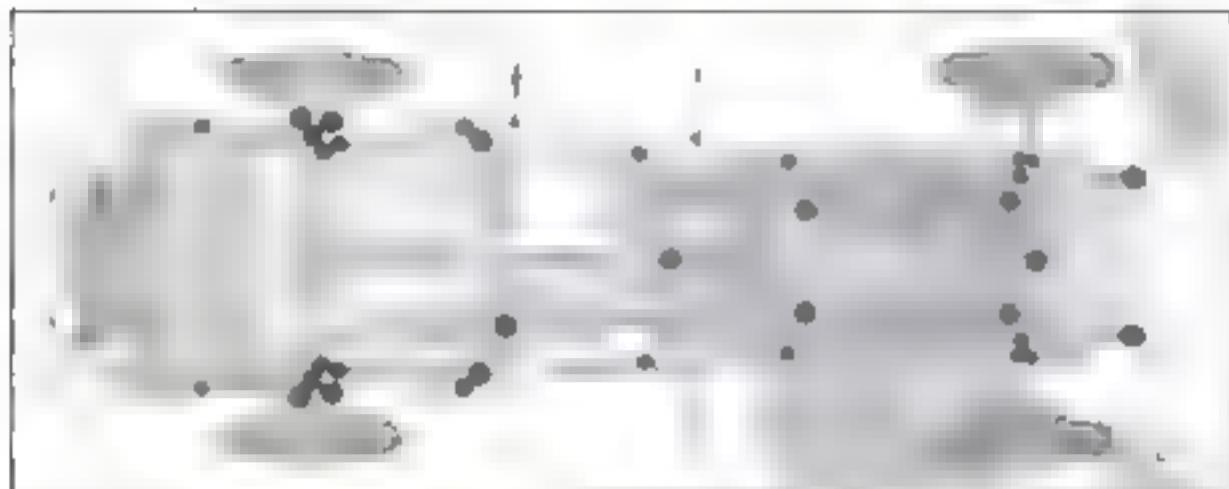
Has Any One Seen His Lost Two Parts of Hydrogen?

WILL you please ask your readers to answer the following problem which occurred to me during my science course in high school? An ordinary nail is placed in enough water to cover it. After a period of time it rusts, taking oxygen from the water. What becomes of the two parts hydrogen which must have been set free in the process of oxidation? Did the hydrogen pass into the air to combine with the oxygen there so that more water would be formed? I surely enjoyed John Carr's article on getting started in amateur radio.—S.H.M., Des Moines, Ia.





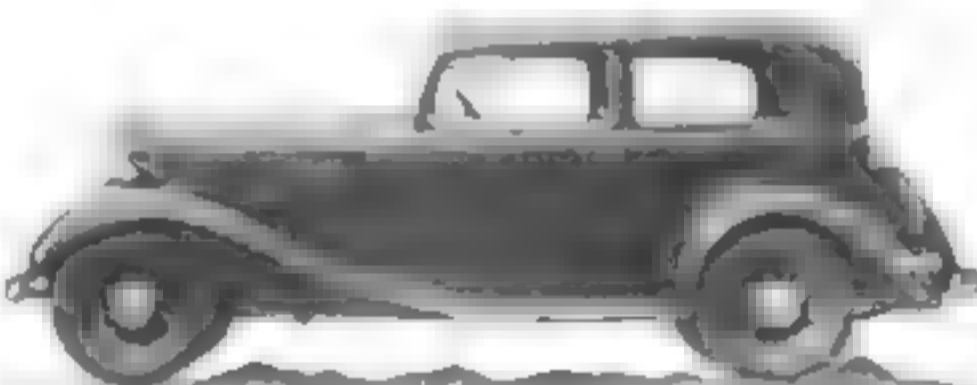
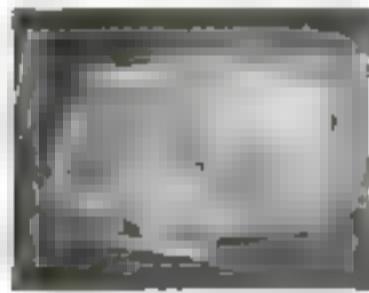
How General Motors Engineers made the PONTIAC ^{economy}_{straight} 8 so Easy Riding



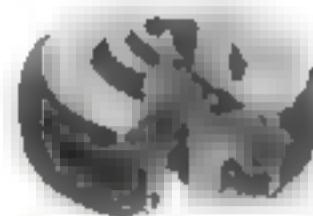
Pontiac engineers determined that the Pontiac Economy Straight Eight should be the most comfortable car in the low price field. And it is! These five rubber cushioning at 55 chassis points. Pontiac's engine is insulated from the frame with 3

rubber mountings. The cushioning between the heavy double-deep, crossmember-strengthened frame and the new, wider bodies by Fisher not only absorbs road jars and shocks, but also decreases the possibility of annoying squeaks and rattles.

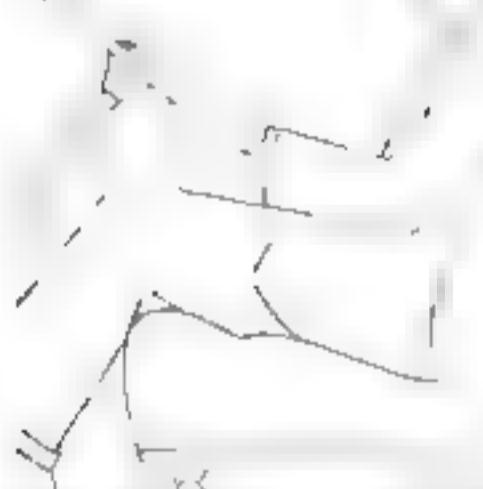
Fisher No Draft Ventilators make it possible for driver and passenger alike to regulate independently the exact amount of *draftless* ventilation preferred—without discomfort to other occupants of the car.



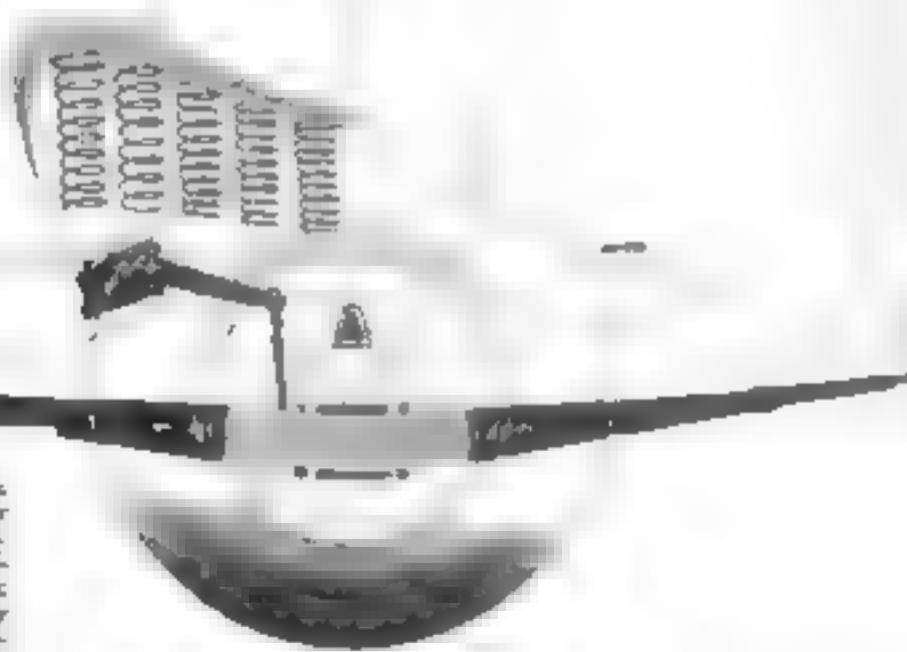
The Pontiac Economy Straight Eight has a wheelbase of 119 inches; the curb weight (4-door Sedan) is 3,630 pounds. Three proportions assure truly big car riding comfort. Illustrated above is the 2-door Sedan, \$635, f. o. b. Pontiac, special equipment extra.

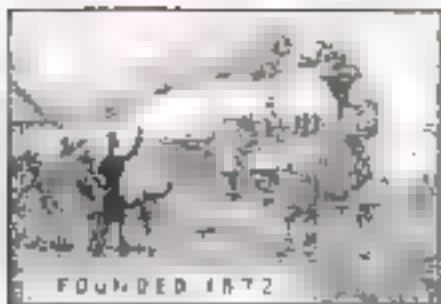


This is one of the three types of steel-encased live-rubber engine mountings used on the Pontiac Straight Eight to eliminate every trace of vibration in Pontiac's big 77-horsepower Straight Eight engine, yet keep it sensibly stabilized in the chassis.



Six definite features help to make Pontiac more comfortable: (1) Big, soft 17 x 5.50 tires deaden jars. (2) Long, permanently lubricated and covered springs of chrome-vanadium steel release riding. (3) Rear springs are insulated from axle by rubber cushioning. (4) Lowriding hydraulic shock absorbers effectively curb rebound. (5) Shams of live rubber insulate body from such shocks as might reach the chassis. Finally, (6) the deep, resilient seat springs in the new bodies by Fisher add their downy comfort to make the Pontiac Economy Straight Eight the easiest riding low-priced car on the road. Priced from \$545, f. o. b. Pontiac, special equipment extra. Easy G. M. A. C. terms. A General Motors Value.





POPULAR SCIENCE MONTHLY

April 1933

Vol. 122, No. 4

RAYMOND J. BROWN, Editor



800 feet *on a Fireproof Rope* Inside a Flaming Volcano



Dangled at the end of an asbestos rope, the intrepid author is seen right during his descent of 800 feet into the heart of the volcano St. Ambroe. He saw a rock on a string was thrown over to get the crater's depth before the descent began. At left: Arpad Kirner



B.
ARPAD
KIRNER

French Engineer and
Scientific Explorer



A SLENDER white thread, a rope of asbestos, rose straight above my head to the edge of the cliff. Below me were boiling lava and billowing fumes. Dangled at the end of the rope I was being lowered 800 feet into the mouth of an active volcano.

A steel helmet protected my head from flying rocks. My suit, my shoes, my gloves, were all made of asbestos. Strapped to my back were oxygen tanks. I had strained not to breathe as I he jones. I was realizing a scientific adventure which I had planned for years.

My friends thought I was crazy when I announced my intention to explore the crater of an active volcano, to descend the depths of its enormous pit, to photograph the internal vent-hole while it fumed and grumbled, to go where explosions rapidly follow one another and where phenomena, still mysterious, constantly occur.

None of those who had preceded me in volcanic studies had dared a descent into a crater in full activity. They

had contented themselves with simple excursions to the mouth of Vesuvius or Etna during quiescent periods. If I succeeded in my plan I knew I would witness phenomena unseen by anyone before. If I returned into open air and sunlight after this trip into an inferno, I would bring back specimens, solid and gaseous, of unusual interest. So I determined to make the effort.

My choice fell upon Stromboli, the volcanic cone rising from the Mediterranean north of Sicily. Why Stromboli? Because it is the only volcano in Europe of uninterrupted activity. Here I risked no dud. In its crater I was sure to find the spectacle I desired.

For me, this volcano was an old acquaintance. I had studied it many times. I had scaled its slopes, approached its mouth and I knew that, from year to year, the shape of its summit underwent modi-

fication. To pick the most favorable spot for my descent, I visited it again. Then I prepared my equipment. All was ready!

It was with the greatest difficulty that we hauled the equipment up the side of Stromboli, which rises sharply from the water without the slightest beach. At the spot previously selected, I prepared for the test. I was secured to the asbestos rope by means of a heavy leather belt similar to those used by mountain climbers. Control of my descent was handled from the top by means of a windlass set up several yards from the edge of the crater. To prevent the rope from being worn away by scraping against the rocks, a pulley was placed at the crater's edge.

Several friends, and some of the island natives chosen for their strength, had accompanied me and worked the windlass to which my rope was attached. As a means of signaling them after my entry

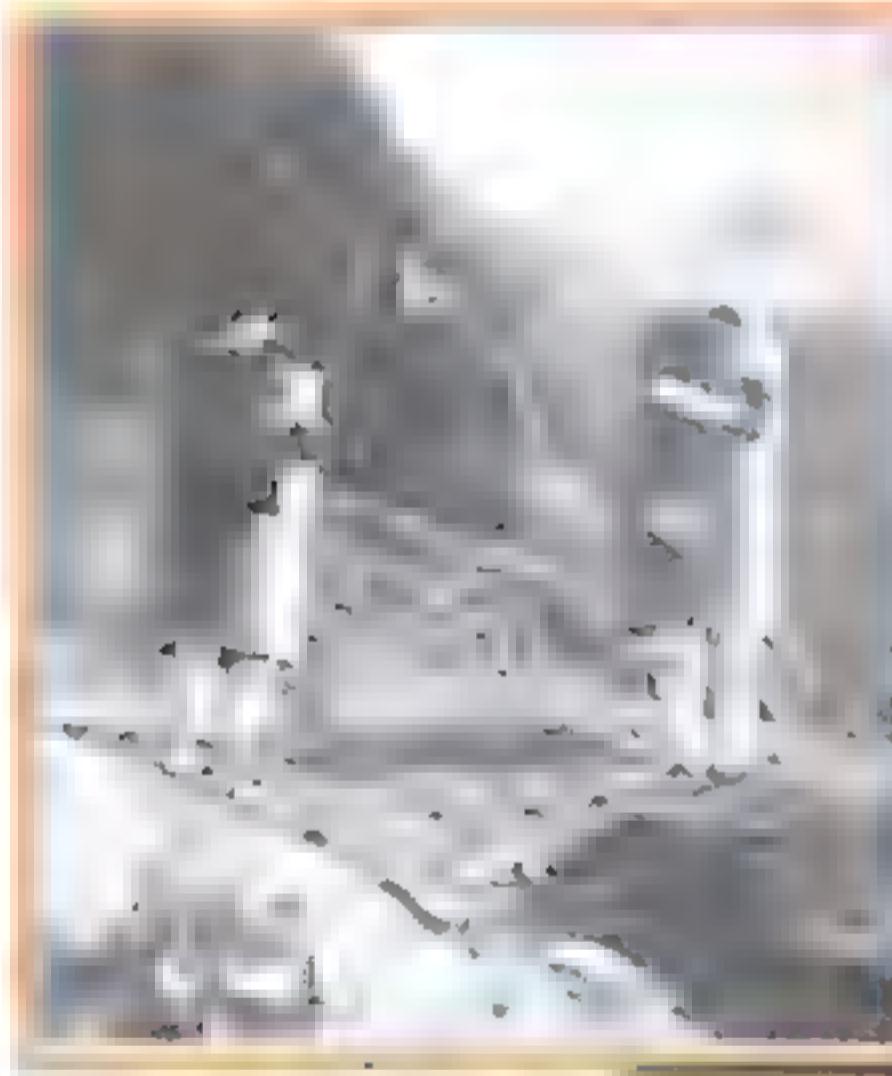
into the crater, I carried an electric hand lamp. Wires running down the asbestos rope supplied the current for the powerful little light.

I realized clearly the danger confronting me as I stepped over the edge of the crater and was lowered slowly into space. I knew my return was problematical. My precautions might prove insufficient. My heart and lungs might not stand the strain of the gases and the terrific heat. Suspended in space, I knew not where I was going nor where I would set down my feet. What awaited me at the end of my descent? Solid rock? Boiling lava? A sheer, slippery ledge with fire below? I could not tell.

As I sank into the pit, I studied the walls of the crater, black, red, yellow, pierced with holes from which sulphurous vapors poured. I saw beneath me immense openings veiled in smoke. When I raised my eyes, I estimated the distance I had descended and asked myself

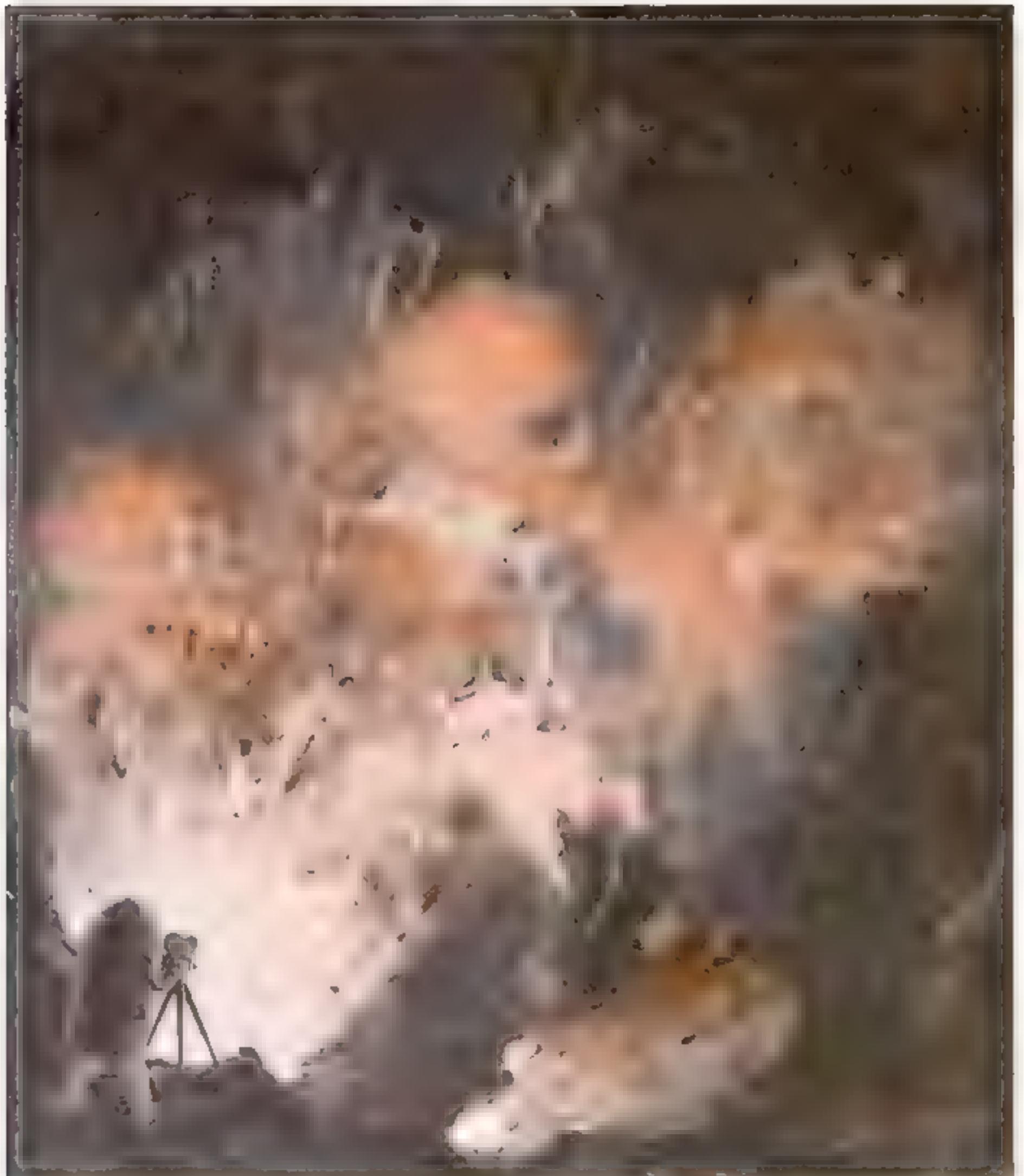
Would the rope stand the
ten ever pull me up, or
would the descent have
ended on a ledge 500 feet
from the bottom of the crater? The rock was extremely
hot. I pulled myself up. I tried
to estimate the temperature of the rock and
found it was as much

*Photographs
of a Volcano
from Inside
and Outside.*



This map shows the position of Stromboli off the western coast of Italy. At upper right, cut-away view of the crater; at lower right, crater floor photographed by Kurne.





INSIDE THE BURNING CRATER. Here is our artist's conception of the interior of Stromboli and of the author wearing his steel armor to ward off flying rocks.

saturated with poisonous sulphurous vapors. Thanks to my oxygen outfit, I was able to breathe and so began a tour of the crater bottom.

Casting off my rope, I set out for the real openings of the volcano—immense vertical pits from ten to thirty feet in diameter. At intervals, with formidable explosions these mouths threw forth jets of lava. The pits, however, slanted in such a way that the lava always descended

on one side. By timing the explosions, I was able to race to the mouths and, in some cases, actually lean over them between eruptions, looking perpendicularly into the interior as one looks down a well.

What did I see there? Beyond a screen of smoke and strangely-colored vapors, I saw an incandescent sea of liquid lava, agitated, boiling, shaken with convulsions.

As I watched this molten sea welled up. The mysterious force which moves

it was about to eject it violently. The time had come for the explorer to flee from his post of observation. Scarcely seconds passed before the explosion came, the orifice spewing forth its jet of lava hurling it hundreds of feet into the air. Great flaming masses fell back into the crater. The rest, thrown farther, rolled and bounded down the flanks of the mountain and plunged into the sea with a hissing of steam.

Three hours passed while I pursued my explorations, timing the rhythm of the explosions. (*Continued on page 110*)



In center ring he saw at an
exit to a temple in
the ancient city he expected
to find many valuable
articles to aid the digging

STRANGE CLUES tell Secrets of Man's Life 20,000 YEARS AGO

IN THE gathering dusk of a late afternoon last November, a group of distinguished scientists sat in an auditorium at the University of Michigan, and listened to the story of the earliest murder known to have been committed within the territory that is now the United States.

The audience was fascinated. Not a paper rustled, not a chair creaked, not a cough was heard in the hall as the speaker reconstructed the killing of a seventeen-year-old girl, probably by a jealous lover, in Minnesota 20,000 years ago.

The grey-haired man on the platform looking like an elderly Sherlock Holmes, was Dr. A. E. Jenks, anthropologist of the University of Minnesota. His listeners were members of the National Academy of Sciences attending the final session of their autumnal meeting at the Michigan city.

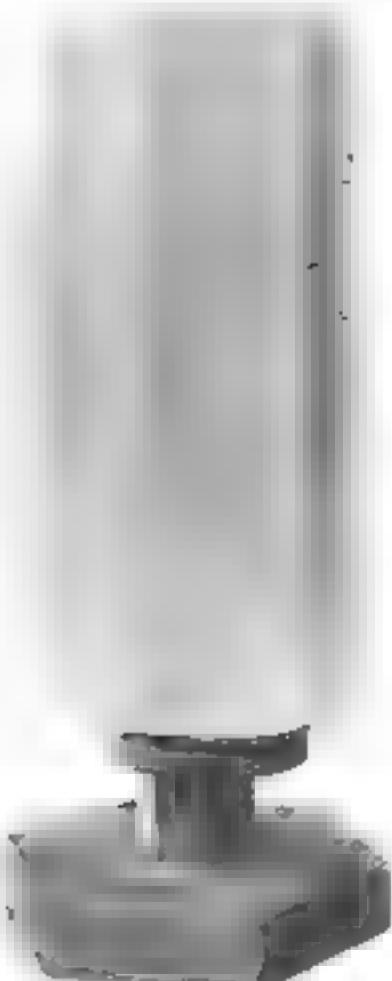
Upon this recorded period of stone was called the record of the campaigns of the Assyrian Emperor Sennacherib

in what now is Otter Tail County, Minn., was shot through the heart with an arrow or stabbed with a spear. The girl was killed either on a raft or was slain ashore and thrown into the water. In any case, her body sank to the bottom, and the mud and silt of 200 centuries sealed and preserved her bones in a natural vault.

There she lay undisturbed until one morning in June 1931 when a road gang repairing a State highway in Otter Tail County cut through an ancient lake-bed and uncovered the girl's skull and part of her skeleton. The engineer in charge decided to submit the bones to an expert.

That is how Dr. Jenks was called into the case. For months he studied the remains. He established the sex and age of the victim. A nick in one of her shoulder blades, obviously made by an arrow-head or spear-point, told the story of her violent death.

Last summer Dr. Jenks returned to the scene of the prehistoric crime, and recovered more of the girl's bones, as well as an antler dagger and fragments of the shell ornaments





Sometimes Egyptian mummy cases were made of a poor grade of paper of which several thicknesses were used. In photo, layers are being separated to find inscription.

she wore in her hair and around her neck and waist. Together with Dr Frank Leverett, president of the American Geological Society and one of the world's foremost authorities on glacial geology, he subjected the clay and sand layers in which the bones were found to a searching examination, showing beyond doubt that the tragedy occurred about 20,000 years ago.

Thus the ancient Minnesota maiden is not only the oldest known murder victim in the United States, but also the earliest human being of whom remains have been found in this country. She furnishes added proof of the theory advanced by Hamm Brown, of the American Museum of Natural History, and others, that people inhabited this country between 15,000 and 20,000 years ago.

With an almost complete skeleton in his possession, Dr Jenks reconstructed the girl and told the National Academy of Sciences how she must have looked. Evidently she was no beauty. She was more Mongolian in type than the Indian squaw of today and, with her large teeth and strongly rounded nostrils, was more ape-like than any woman now living.

That part of Dr. Jenks's address was perhaps the most interesting to his learned audience, for it suggested that man's development from lower forms may have taken place in this country as well as in far-off Asia and Europe.

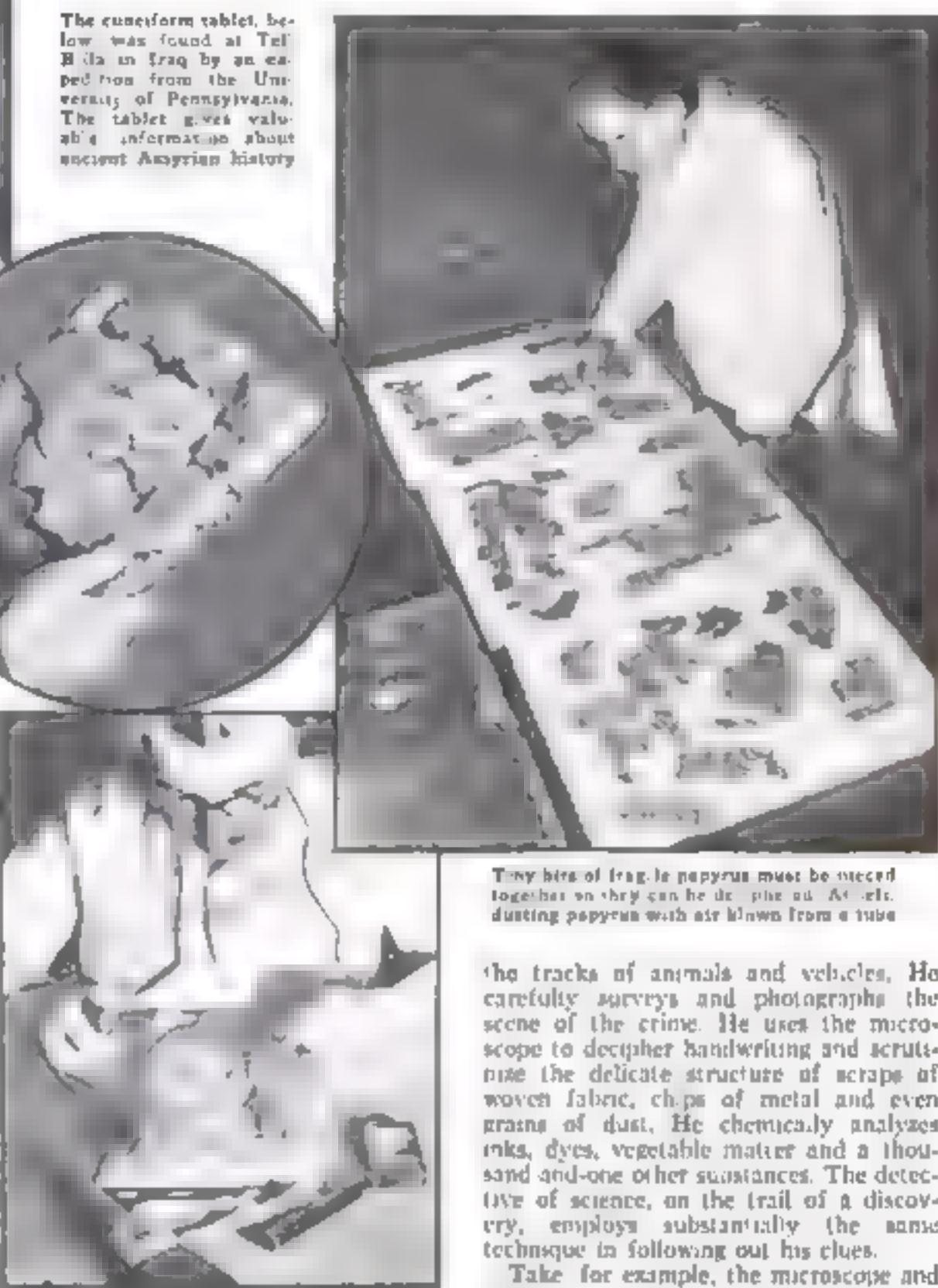
Who killed Miss America of 18,000 B.C. probably will never be known. The killer's dagger he found, Dr. Jenks believes, was her own and not her assailant's. But the fact that this phase of the mystery remained unsolved did not diminish the enthusiasm of the members of the National Academy. They characterized this country's first murder victim as "one of the most important anthropological discoveries ever made in North America."

To the Minnesota workmen coming upon the slain damsel's skeleton that June morning, the grisly find was just a

Latest Instruments and Methods Are Used by Scientists in Unraveling Ancient Mysteries

By MICHEL MOK

The cuneiform tablet, below, was found at Tel Bala in Iraq by an expedition from the University of Pennsylvania. The tablet gives valuable information about ancient Assyrian history.



Tiny bits of fragile papyrus must be pieced together so they can be deciphered. Above, dusting papyrus with air blown from a tube.

bunch of old bones. It was Dr. Jenks's knowledge, combined with his skill and his powers of observation and deduction, that transformed the human fragments into a priceless relic of American pre-history. In other words, what the anthropologist did was nothing more nor less than a brilliant piece of detective work, done for scientific reasons.

Because of the crime element that proved such a dramatic feature of this case, the analogy between the work of the scientist and that of an astute detective on the trail of a law-breaker, happens to be particularly obvious and striking. But it is through shrewd and patient sleuthing of this kind that most of the secrets and wonders of the past have been brought to light.

In the detection of crime, the police investigator studies finger and footprints,

the tracks of animals and vehicles. He carefully surveys and photographs the scene of the crime. He uses the microscope to decipher handwriting and scrutinize the delicate structure of scraps of woven fabric, chips of metal and even grains of dust. He chemically analyzes inks, dyes, vegetable matter and a thousand and-one other substances. The detective of science, on the trail of a discovery, employs substantially the same technique in following out his clues.

Take for example, the microscope and the part it plays in reconstructing the man's customs, and culture of peoples who have been dead many centuries. With the return of legal beer on the horizon as this is written, the manner in which the modern lens recently aided a scientist in revealing the secrets of the brews quaffed by the German warriors of the Middle Ages, is particularly timely.

Two ancient drinking horns found buried in a peat bog in northern Germany, were brought to Professor Johannes Gruess, of Freuchshausen. Close inspection showed the scientist that the horns contained hardened heelaps of some liquor, probably centuries old. He loosened and soaked the stuff and then made a thorough microscopic examination of these dregs.

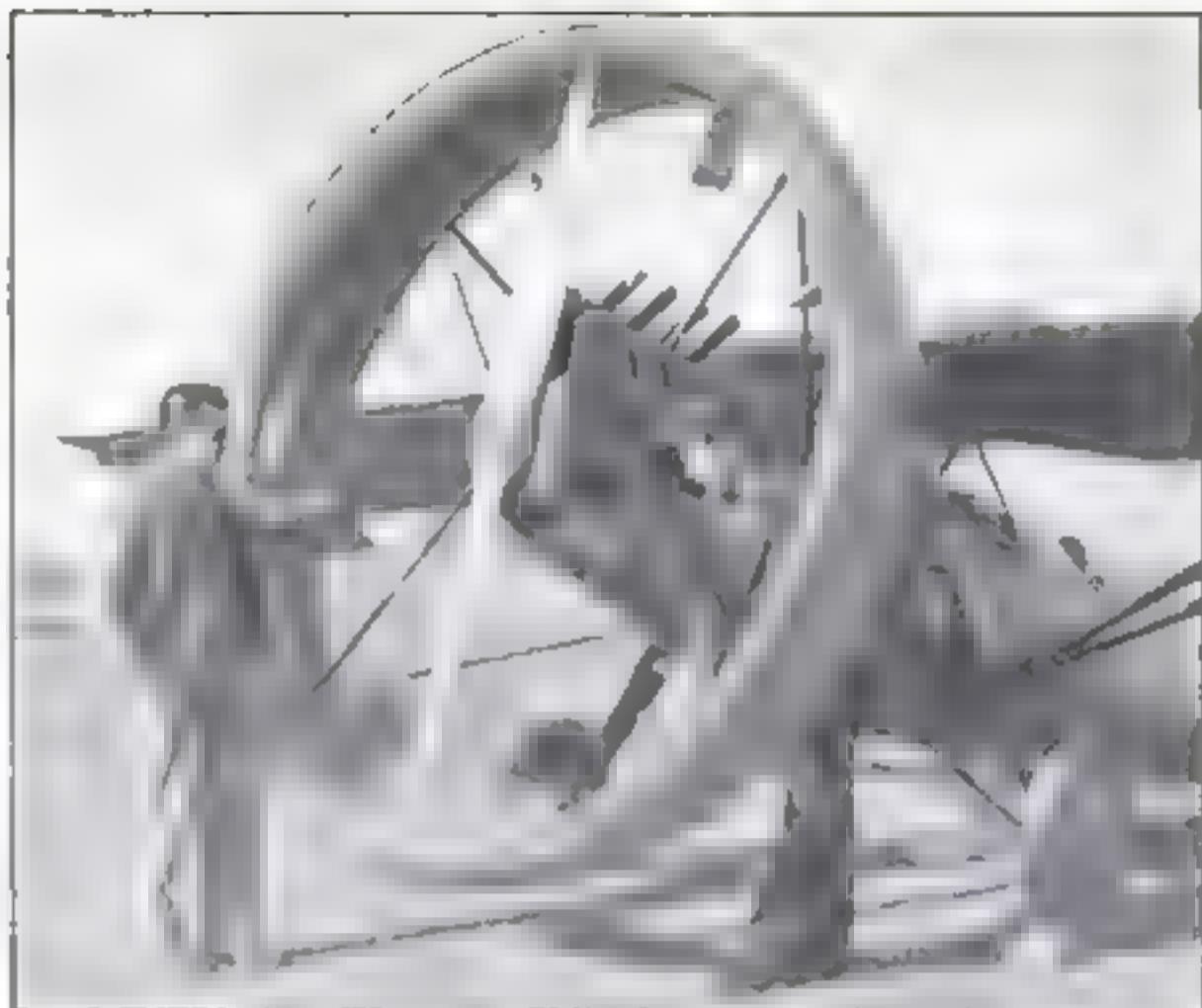
One of the horns, he discovered, was an antiquated beer Stein, the other had been used for (*Continued on page 113*)

VALVE IN PLANE'S FUEL LINE ENDS FIRE DANGER

FIRE following an airplane crash is prevented by a new magnetic valve devised by a Westinghouse engineer. The valve, inserted in the gasoline line, is held open as long as the plane's engine is turned on. When a pilot sensing danger cuts off the ignition switch, the valve automatically closes under the pressure of a spring. This makes it impossible for a broken fuel line to spray or leak gasoline. The magnetic valve will also control many steam-driven devices.



Plunger held by right hand opens valve; left and a former in which it fits close it.



PROPELLER RING RAISES PLANE'S SPEED

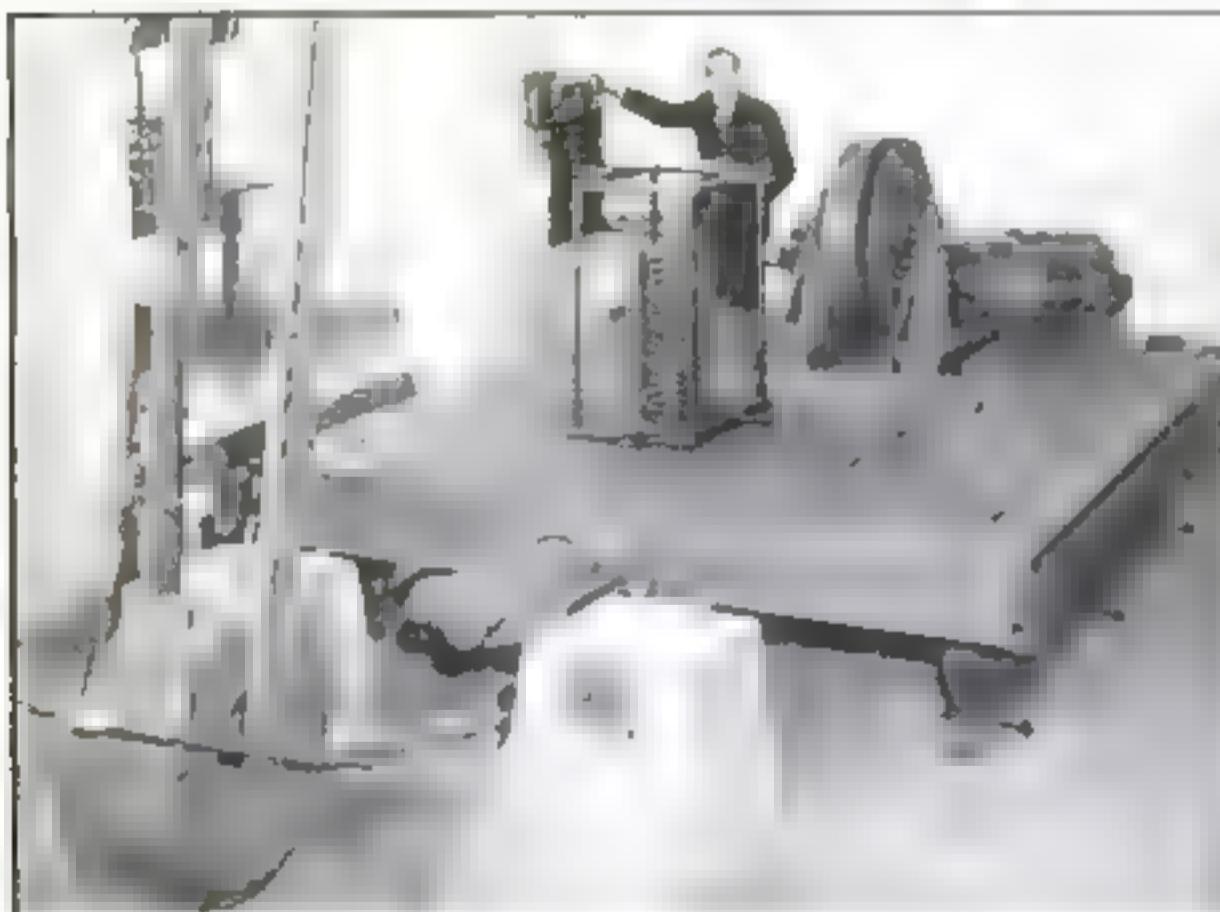
THE speed of an airplane may be increased from thirty-nine to 140 percent by putting a ring round the propeller to be discovered announced by two Captain E. G. Jenkins. The circular covering is 11 inches high by one-half inch in diameter.

The propeller and ring results effectively. A new way of cutting, which the inventors call "ring cutting," has been developed for cutting the propeller ring. The Resin Lining

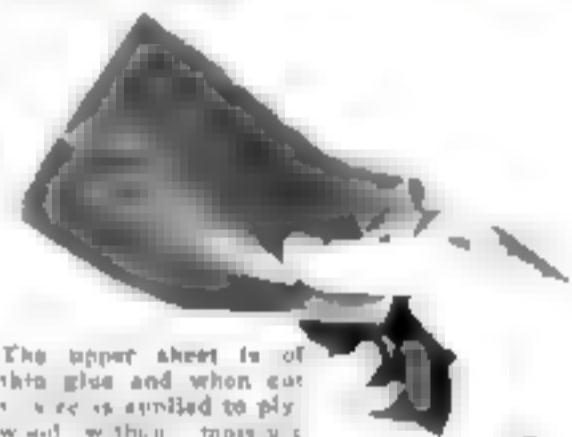
MODEL SKYSCRAPERS GET QUAKE TEST

How to make buildings earthquake-proof is the object of an unusual series of tests in progress in the engineering laboratory of Stanford University, at Palo Alto, Calif. Model skyscraper parts are subjected to artificial earthquakes on the vibrating table illustrated below, to de-

termine their relative ability to withstand shocks. Impacts of a massive pendulum at the lower left in the picture are transmitted to the table through a spring plunger causing it to vibrate rapidly. Another type of vibration is provided by an off-center flywheel.



Model of skyscraper set on this table is subjected to earthquake shocks to test resistance of materials. Pendulum at the lower left and the flywheel at rear produce artificial vibrations.



The upper sheet is of thin glue and when cut it is applied to plywood without moisture.

GLUE IN THIN SHEETS USED WITHOUT WATER

IT looks and feels like paper—but the dark sheet in the picture above is actually glue, in a new ready-to-use form. The thin yellow-brown sheet comes in rolls and is cut and applied as needed to plywood or veneer. Requiring no moistening, it is said to give a strong, waterproof bond between sheets of plywood subjected to heat and pressure in a hot-plate press. Since the sheet is uniformly 0.015 in. thick, the same glue spread is always obtained over the entire surface of the plywood.

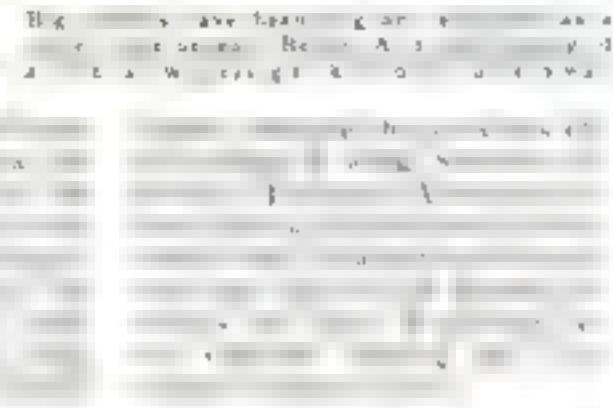
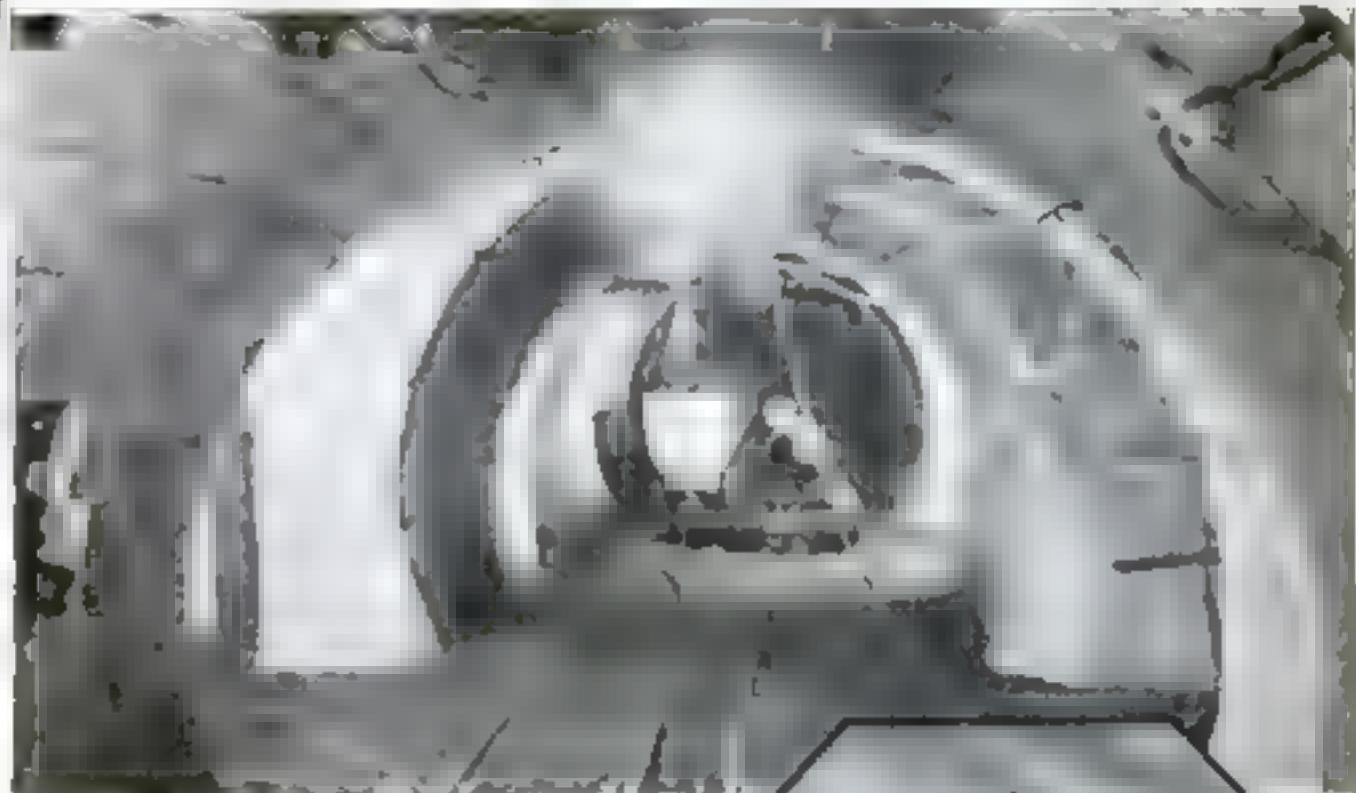
PAPER TUBES NOW FORM HOMES FOR OYSTERS

PAPER tubes, coated with cement form new incubators for baby oysters. The tubes, to which the microscopic oyster larvae cling until they develop into seed oysters, have been developed by the United States Bureau of Fisheries at Beaufort, N. C., station.

Model Mine Under Berlin Is Miners' Classroom



The working model of a coal mine is shown in a way that makes it a classroom.



CROOKS' BOMBS STUDIED FOR CLUES



Type	Length	Diameter
A	200 mm	100 mm
B	200 mm	100 mm
C	200 mm	100 mm
D	200 mm	100 mm
E	200 mm	100 mm
F	200 mm	100 mm
G	200 mm	100 mm
H	200 mm	100 mm
I	200 mm	100 mm
J	200 mm	100 mm
K	200 mm	100 mm
L	200 mm	100 mm
M	200 mm	100 mm
N	200 mm	100 mm
O	200 mm	100 mm
P	200 mm	100 mm
Q	200 mm	100 mm
R	200 mm	100 mm
S	200 mm	100 mm
T	200 mm	100 mm
U	200 mm	100 mm
V	200 mm	100 mm
W	200 mm	100 mm
X	200 mm	100 mm
Y	200 mm	100 mm
Z	200 mm	100 mm

FASTEAST TRAIN'S SPEED SHOWN ON SPEEDOMETER



LOUDSPEAKER, INSTALLED IN TOWN, SERVES AS BELL CHIMES



The loudspeaker on the roof replaces the heavy hammer or hour bell. At right, the control mechanism with the electric clock. At upper right:



Loudspeaker chimes, recently developed for use in the clock towers of buildings, have the distinction of an inexpensive feature—no unnecessary bells. These simple electronic chimes can be struck at any hour of the day or night. A small microphone picks up the sound which is amplified and made audible through powerful loudspeakers on the roof of the building. One of the new installations is said to duplicate the clang of a 400-pound hammer upon a six-ton bell.



This tubular bell weighs only five or six pounds, one-fifth the size of a larger bell.

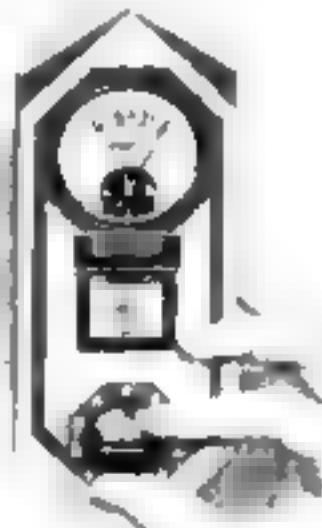
LIGHT PRINTS TIME ON CLOUDS



This clock face set in the projector throws time on clouds.

This unique device, the first of its kind, or possibly similar, was H. G. Matthews, British inventor, has developed a new way of projecting light rays. A carriage supports the cannon-like projector which is designed to throw signs upon clouds miles away and is an improved model of one he demonstrated in New York City not long ago. By inserting a special clock with a transparent arc and opaque hands and figures in the projector, the correct time is also thrown on clouds.

With his gun she is a
factor alone
but she
can't get
anywhere
no time on
clouds that
are far away

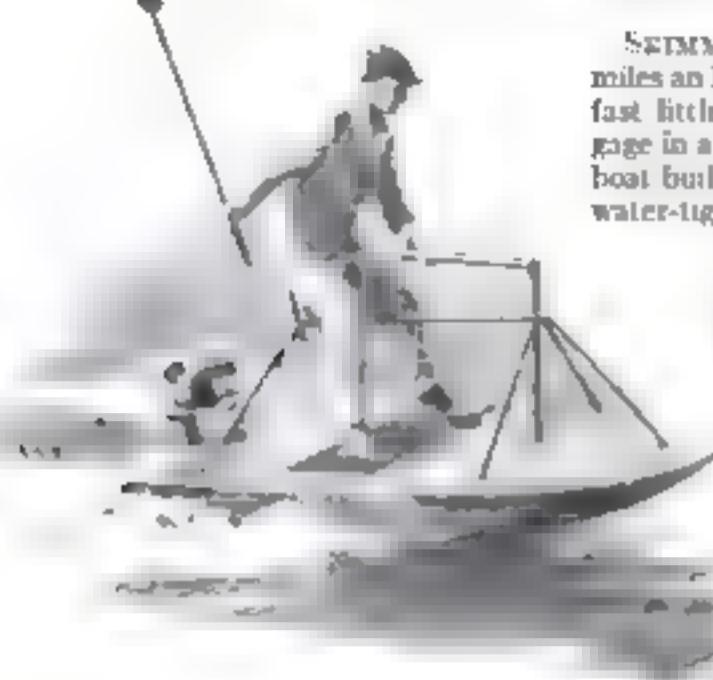


Turning knob at bottom of the aluminum case extends a line to any room in house.

NINE THERMOMETERS COMBINED IN ONE

By turning a knob at the bottom of a new household thermometer the user can test the temperature in any room in his home. The device works by direct and extension wires to nine separate indicators suitably distributed. A sufficient number is provided according to engineers who developed the instrument so that the temperature within the home refrigerator and the hot-water heater may be observed as well as that of any room in the house.

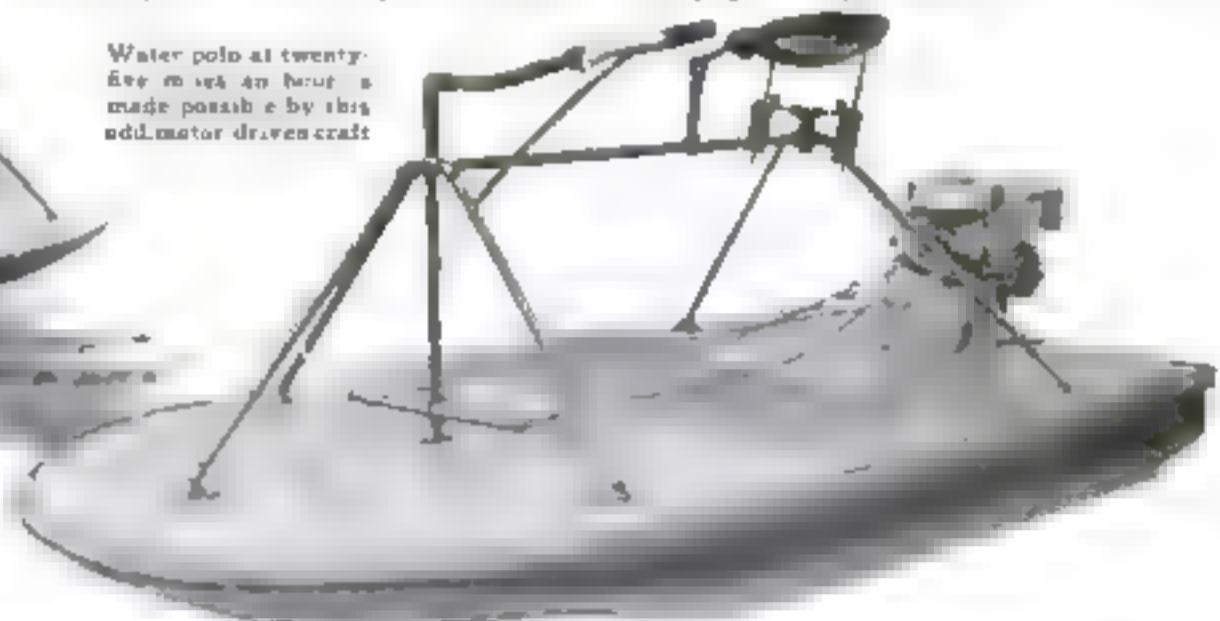
New Power Boat for Polo on Water



The player of this new, the dingy kind of water polo steers with his feet and has one arm free to wield the mallet.

SWIMMING over the water at twenty-five miles an hour, wheeling in their own length, fast little water polo boats may soon engage in a thrilling new sport. A New Jersey boat builder has designed a special craft, a water-tight pontoon driven by an outboard

motor and carrying on its back a bicyclic-like framework, for the use of water polo players. It is steered by means of a rudder bar operated with the feet and the motor is controlled through a single motorcycle hand grip leaving one hand free.



READING GLASS HELD BY STAND

For the convenience of those who require a magnifying glass for reading or in their work, a New York manufacturer has produced a compact outfit in which the enlarging lens is held by adjustable arms attached to a broad base that rests upon a table or desk. The reader can use both hands to hold a book and turn the pages, once the glass is set in the proper position.



BRIDGE FLOOR IS MADE OF STEEL MESH

When engineers in Seattle Wash recently decided to widen a bridge in the city, they found the machinery that elevates the center section would be unable to handle the additional weight if the span were floored with concrete. So they fitted the enlarged bridge with a floor of steel mesh. Automobiles and street cars cross the bridge, running on the mesh floor which is fifty per cent air. The photograph clearly shows the open-work floor of the bridge as the picture was taken when one section was raised.

USE SEESAW TO START STOPPED HEART

A LITTLE SWINGING seesaw has been invented by a University of California scientist to revive those whose hearts have stopped, as the result of certain kinds of accidents. While oxygen is forced into the lungs and heat is applied to the body, the patient will be rocked steadily up and down on the pivoted plank, to which he will be strapped lying on his back. The theory is that the steady change in position will cause gravity to send the blood coursing through the veins and will start the heart beating. The apparatus, the inventor points out, is for use only in certain cases where the patient has met with an unusual accident.



The patient is rocked while oxygen is administered

TWO NAIL SETS IN ONE



One point of this tool sets large nail. The other tucks and brads

Two nail sets are combined in one tool recently invented to save time in driving home nails of different sizes. One point drives small nails and brads, while a second, at right angles to the first, is for use with larger nails. The odd shape of the tool makes it convenient to use.

THIS remarkable article tells you how the ingenuity and skill of motion picture directors solve the hard problem of putting on the screen the forms and noises of animals that have been extinct thousands of centuries



Prehistoric Monsters



GROWLS AND GRUNTS. With the aid of this device held on ground, the strange no-sounds made by the long since vanished triceratops & other like animal were reproduced for the film

FROM the same of tropical mud comes the ghost voices of prehistoric monsters have reached the screen. Hisses and grunts of the pterodactyl and brontosaurus roar from a tyrannosaurus, largest of the dinosaur family, groans and roars of an imaginary giant ape are reproduced by mechanical contrivances.

Kong, the ape, crashed through the heavy growth of an unknown forest uttering fierce growls and beating his breast in rage. As the scene unfolded in silence before a small group of us in a tiny project room, the studio sound experts discussed ways and means of re-creating his awful voice and the solid thumps of clenched bands against the massive chest.

An hour later we assembled in the scoring room, with a half-dozen contrivances at hand. Some of these it was hoped, would turn the trick.

"Gentlemen," said Murray Spivack, sound supervisor, "this is our most important noise in King Kong." If it's okay, the rest of our problems will be simple. The ape must beat his breast and growl."

Spivack took his place for the first recording at a kettle drum. The instrument was covered with a heavy board, a cloth stretched tightly across its face instead of the customary skin. In his hand he held two padded drum sticks.

"Bong—Bong—Bong." He struck the board again. The room filled with the

HOW THE GIANT APE BEAT HIS CHEST

Striking the man's chest with drums at the place where the microphone was held against his back, gave the movie the noise of an ape beating his chest.

HEAVY BREATHING

With the bellows right, the noisy breathing of a forty-foot gorilla was produced

resonant tone, but the depth and solid, fleshy sound one would expect to hear could not be made.

"Too hollow for Kong," said Walter G. Elliot, specialist in sound effects for the studio. "Let's try the floor."

Spivack turned from the drum to a nearby chair. Again simple implements began to play their parts in the filming of this imaginary tale of an unknown world. An assistant held the microphone's delicate diaphragm an inch above the floor. Meantime the chair had been placed on a soft fibrous padding. As a bell outside the thick door rang warning that sound recording was about to begin, Spivack began to beat the cane bottom of the chair with the drum mallet.

The beats gave a sober sound I thought they resembled those one would expect to hear from the pounding of a great animal breast, but the sound-speaker slung over the earing said "no good."



THE DEATH RATTLE. Grunting and gurgling in a megaphone held close to the mike gave the screen the no-sounds made by a dying monster many centuries ago



By
ANDREW R.
BOONE

Roar and Hiss for Sound Film

before turning to his sound library for further suggestions. "If wood will not take the place of flesh," he said, "let's use flesh."

Accordingly three men stepped within range of the microphone. An aide held the delicate recording apparatus against Elliott's back. Spivack began tapping Elliott's chest, first lightly then with stronger blows, as he observed the sound men within the little room. At last one nodded and the speaker boomed, "Okey. We pick up the resonance. That gives us plenty of lowa." Which, translated, meant the metal ear had picked up the low notes with clarity and transmitted the body blows with considerable volume to the loud speaker.

"Strange as it may seem," Elliott remarked, "this breast-beating business has given us more concern than the vocal sounds these ancient brutes uttered. Now I'll show you how we think they talked."

In a moment the room was plunged into inky blackness and as we found seats around the walls the picture of the ape filled the screen. He appeared to be some seven times taller than a man as he stood erect on the domed top of New York's Empire State Building, battling with his gnarled, hairy hands an entire squadron of Uncle Sam's army pursuit planes. He alternately roared venom at his aerial enemies and uttered deep-throated love notes over the form of a girlish figure that lay perilously near the edge of a cornice far above the street.

"How," I asked, after the sequence had run its course, "did you achieve such a

deep roar? No animal living today sounds in the least like that."

"That roar," Spivack explained, "provided a difficult problem, but old sound tracks finally solved it for us. You see, we have a half-million feet of animal sounds in the library—leopards, lions, tigers, elephants, every animal in fact, we would be apt to use in pictures."

We took one of these stock roars, ran the sound track backward at a slow speed through the projector, lowered the sound one octave and re-recorded it. From this we took the high spots, the loud peaks, and pieced them together. After we had shortened the roar in this manner it left us with a sound track too short to fit the ape, for his mouth was still open after the roar had ended. So we pieced four of these combined roars together, to keep the roar sustained, then put a sound tail on the end so it would die down naturally instead of stopping abruptly—and we had the awe-inspiring sounds you have heard."

But why, I asked, "wouldn't some living animal's roar have done the trick?" A question, for instance?

"The trouble with the roars of living animals," Spivack said, "lies in the fact that audiences recognize them. Even the most terrifying notes would be recognized. Also, the majority of roars are too short. The elephant, with the longest roar of which I know, sustains the sound only eight or nine seconds. Kong's longest continues for thirty seconds, including six peaks and a three-second tail."

When Kong fought to the death with a tyrannosaurus, a metal and rubber and fur reproduction of those tiny-brained giants that a million years ago roamed the region of what today is Montana, the ape barked, uttered guttural growls and breathed low, heavy gusts before breaking the tyrannosaurus' neck.

As I looked at the giant ape head used for the close-ups I saw a mechanical creature that outdoes nature at its best. Thirty bear skins formed the hide. The rubber nose and rubber (Continued on page 106)

WALKING THROUGH SAND

When the giant ape lumbered across a strip of sand, the noise he made was realistically reproduced by primitive methods

Sound technicians sitting in the tiny glass-windowed control booth had been hearing these synthetic ape sounds through the transmitting system, exactly as a theater audience would have heard them. "Not fleshy," was the cryptic comment.

Spivack still had another method to try

HOMEMADE INSTRUMENTS GUIDE SAILOR ACROSS OCEAN

This eighteen-foot sailing skiff crossed the Pacific from Australia carrying a one-man crew and was guided by his homemade instruments.

WHEN Fred Rebell ended a lone 5,000-mile voyage from Australia the other day in sailing his eighteen-foot skiff *Elante* in to Los Angeles harbor Calif., he owed the success of his perilous adventure to homemade instruments and the knack of using them.

At forty-six, Rebell determined to end

his twenty-year career as a building contractor in Sydney, Australia, and rejoin his parents in their Latvia home. Three weeks browsing among textbooks on navigation in the Sydney public library, convinced him he could make the Pacific crossing himself. Sea-faring men shook their heads dubiously, however, as Rebell headed his frail craft out to sea.

He took bearings with a crude sextant he had fashioned from a Boy Scout telescope, three bits of colored glass, and scraps of old iron. A dollar watch served as his chronometer. From time to time Rebell turned astern his homemade log, a corkscrew-shaped piece of metal. A flexible shaft connected it to a second dollar watch in such a way that moving hands on the dial would indicate the distance covered.

A log spun in the water

and pilot charts of the

north and south Pacific completed the lone navigator's equipment. With his homemade instruments, Rebell held his course through stormy seas.

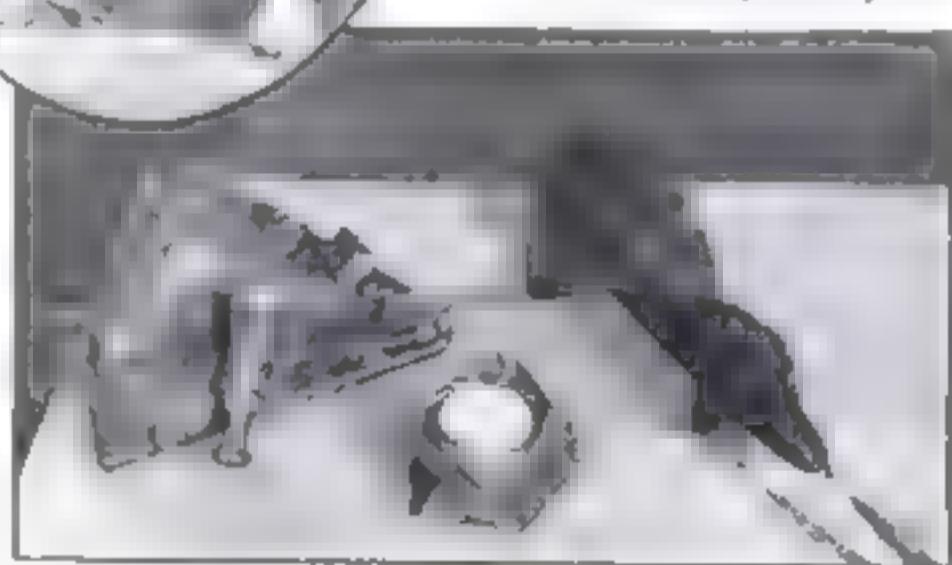


BIG ELECTRIC VIBRATOR HELPS BUILD BRIDGE

To aid in building the great San Francisco-Oakland bridge and other large structures, research engineers of the University of California have perfected the oversize electric vibrator pictured above. It will be used in tamping down concrete and will cause the material to set to a more compact mass than is obtained by usual methods. Another achievement is a cement that develops little heat in setting.



In the picture Fred Rebell, lone navigator of the tiny skiff, exhibits the sextant he made for the voyage. At right is a set up of his instruments consisting of sextant, chronometer and corkscrew log.



BUILD MODEL RAILWAY FOR CHILDREN

STREET car employees of Stuttgart, Germany, have built a model trolley line through woods near the city for the entertainment of the youngsters. The track is carried over rough ground and boulders on concrete piers, and measures 660

feet from end to end. Its rolling stock consists of a pair of midget cars, holding eighteen children apiece. Current supplied from an overhead wire enables them to attain a ten-mile speed. Photograph below shows the train in operation.



German street car employees built this model trolley line 660 feet long through the woods for the entertainment of the children. There are two cars, each big enough for eighteen passengers.

Insects Are Actors in Remarkable Movies



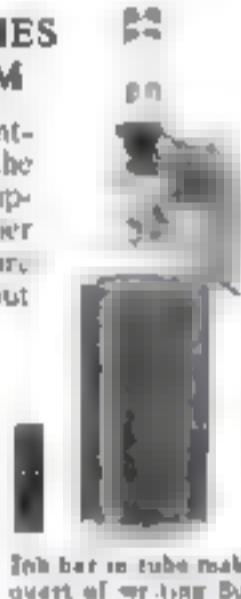
Insects are actors in an unusual series of motion pictures filmed by Stacy Woodward, of Hollywood, Calif. Armed with a long-range lens and aided by infinite patience, he succeeded in recording vivid scenes of deadly scorpions in battle, of hunting wasps stalking their prey, and of

other rarely-viewed wonders of the insect world. One of his most prized sequences shows the hunting wasp seizing a cricket, its natural prey, and paralyzing it with a drop of venom from its stinger. To obtain it, he had to build a complicated system of runways to guide the wasp before the

camera lens. The runways terminated in an enclosure in which he placed the crickets. Sometimes he was forced to wait half a day for a wasp to enter one of the runways. At last, however, a wasp would spring upon its victim, pick it up, and carry it away.

**INK NOW COMES
IN BAR FORM**

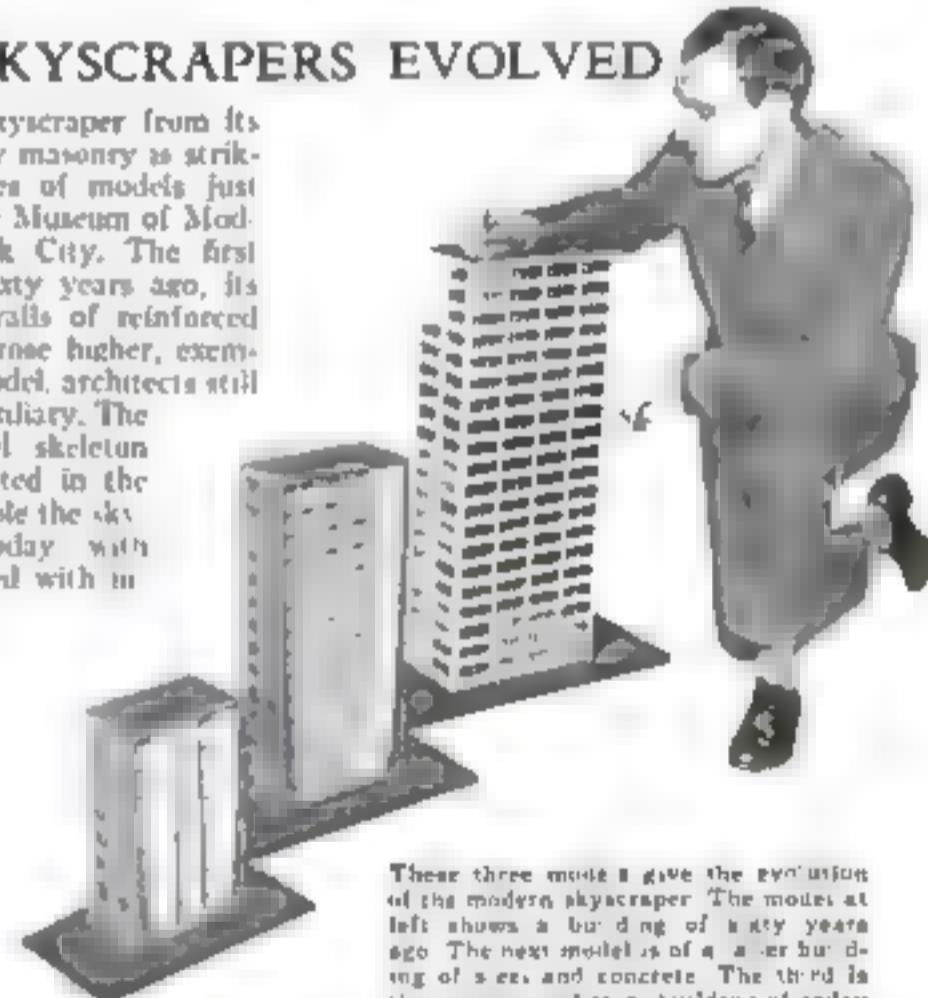
TNK in bars has recently been placed on the market. Each bar is suspended in a special paper tube and finger pressure breaks it out without handling. For use one of the bars is dissolved in a quart of water. The bar can be broken in half or even into smaller pieces if the full quantity is not required.



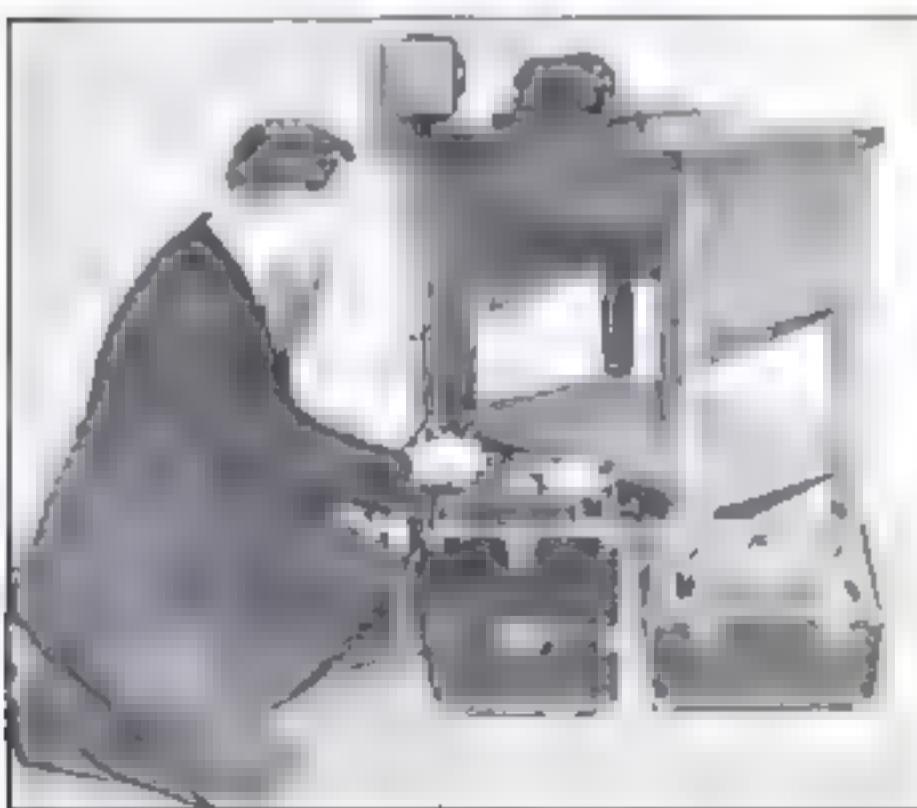
Test bar in tube reactor
ovens at working pressure

HOW OUR SKYSCRAPERS EVOLVED

The evolution of the skyscraper from its squat ancestor of heavy masonry to strikingly shown in a series of models just placed on display at the Museum of Modern Art, in New York City. The first shows a building of sixty years ago, its weight supported by walls of reinforced concrete. As buildings rose higher, exemplified by the second model, architects still used steel only as an auxiliary. The advent of the all-steel skeleton construction demonstrated in the third model made possible the sky-reaching towers of today with their walls honeycombed with innumerable windows.



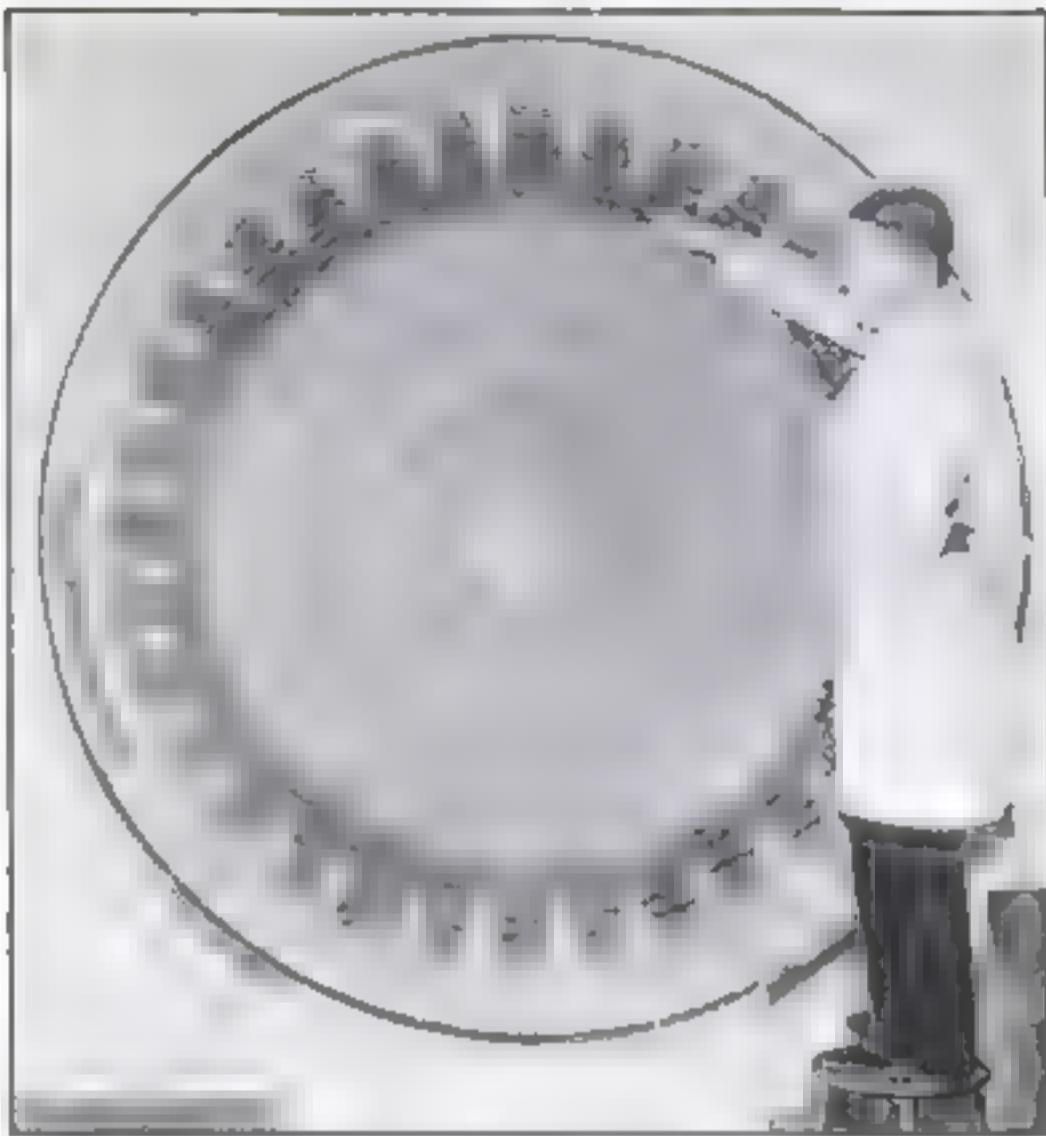
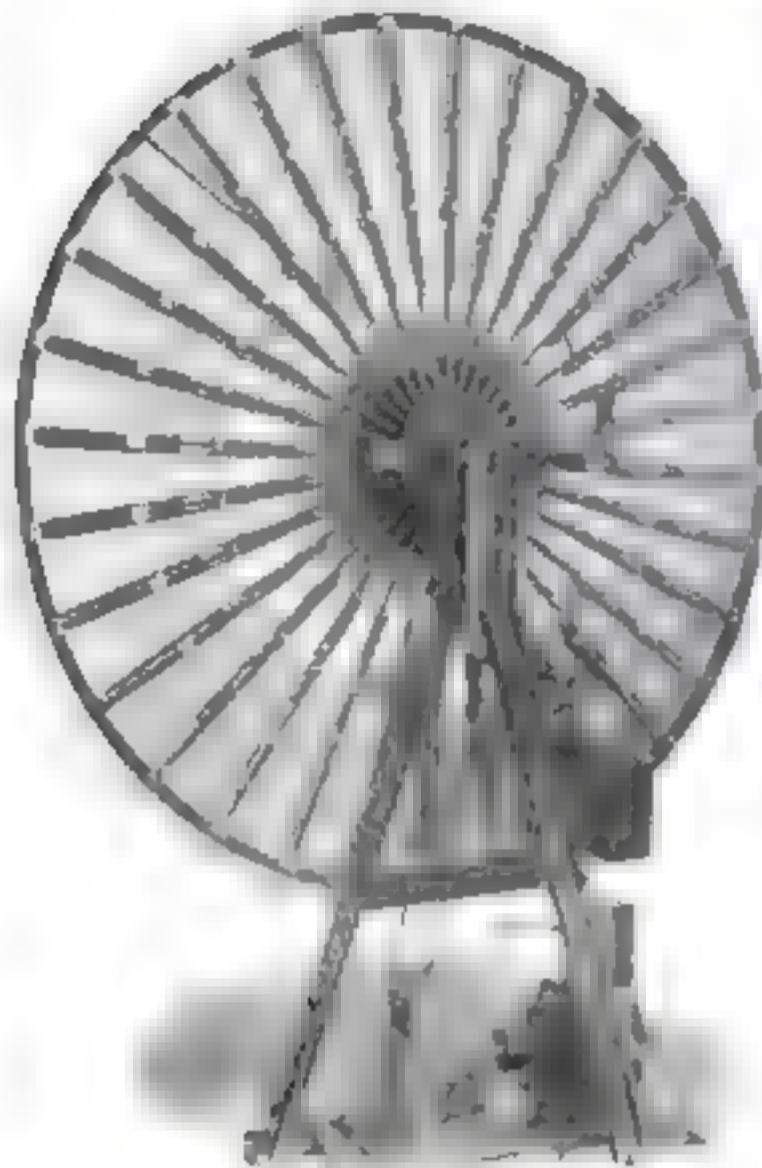
These three models give the evolution of the modern skyscraper. The model at left shows a building of forty years ago. The next model is of a steel building of steel and concrete. The third is the most up-to-date building of today.



TAKING HUM OUT OF MOTORS

Even the diminutive electric motors that run fans and vacuum cleaners have come in for attention in the war against noise. To aid in eliminating objectionable hum, the miniature broadcasting station pictured at the left, has been set up in an East Pittsburgh, Pa., research laboratory. When a motor is running on the table before the microphone, the intensity of the noise it makes is registered directly upon an electric dial. Thus engineers are able to compare different types, and to redesign a motor until they take the hum out of it. The apparatus used is known as a noise analyzer, and may be applied to measure noises originating from any source.

Gears In Young Tree Model Make It Grow as Though Alive



This model of a tree, for the Chicago World's Fair, will grow, adding new cells, when driven by the motor and mechanism shown in picture at left.

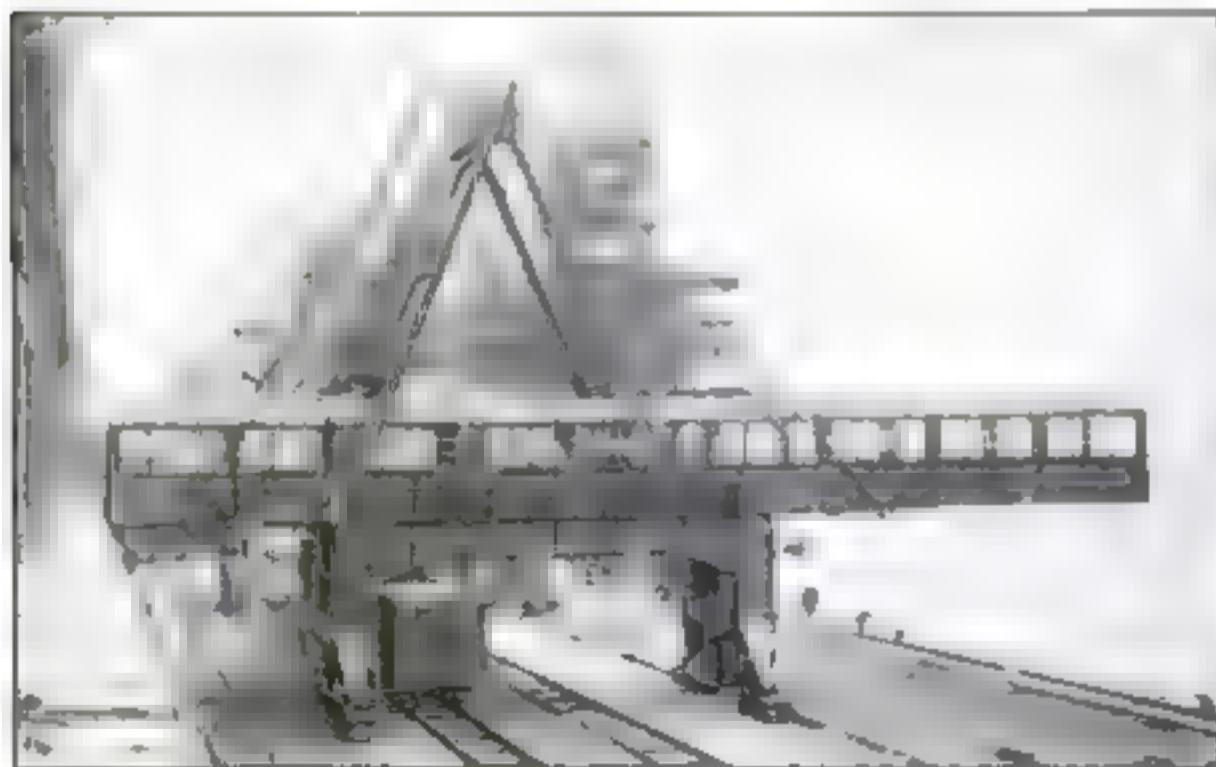
A MECHANICAL twig, seven and a half feet in diameter, will show visitors at the Chicago World's Fair next summer how a tree grows. Sliding plates and moving canvases will add an eighteen-inch ring to the model and reproduce a year's growth in a minute and a quarter. The model rep-

resents the cross-section of a three-year-old basswood tree a quarter of an inch in diameter. Its cells are magnified 360 times. Basswood was chosen because it is the type of wood studied by practically all students of trees. Through worm gears, an electric motor will slide the new cells in o-

pace, forming an outer ring that represents the fourth year of growth. The motor and gears are hidden in an enclosed case at the back, and the mechanism is so arranged that the model automatically returns to its three-year size at the end of each demonstration.

GOLFERS' NEW PUTTER HAS GUIDE ON BLADE

A NEW putter for golfers has a metal flange, three-quarters of an inch wide and nearly three inches long, extending backward from the blade. With a correct stroke, this flange is parallel to the ground at the bottom of the swing. If the flange digs into the earth, the swing is wrong.



MOVING GANGWAY SPEEDS TRAVELERS

PASSENGERS leaving transatlantic liners at Cherbourg, France, will soon use motorized gangways designed to speed their disembarking and the handling of their luggage. The gangways, operating like escalators, or moving stairways, can be

elevated or lowered to any level to meet the requirements of different-sized vessels. Covered over to give protection to passengers in bad weather, the moving gangplanks will roll along on tracks and lock securely in place for operation.



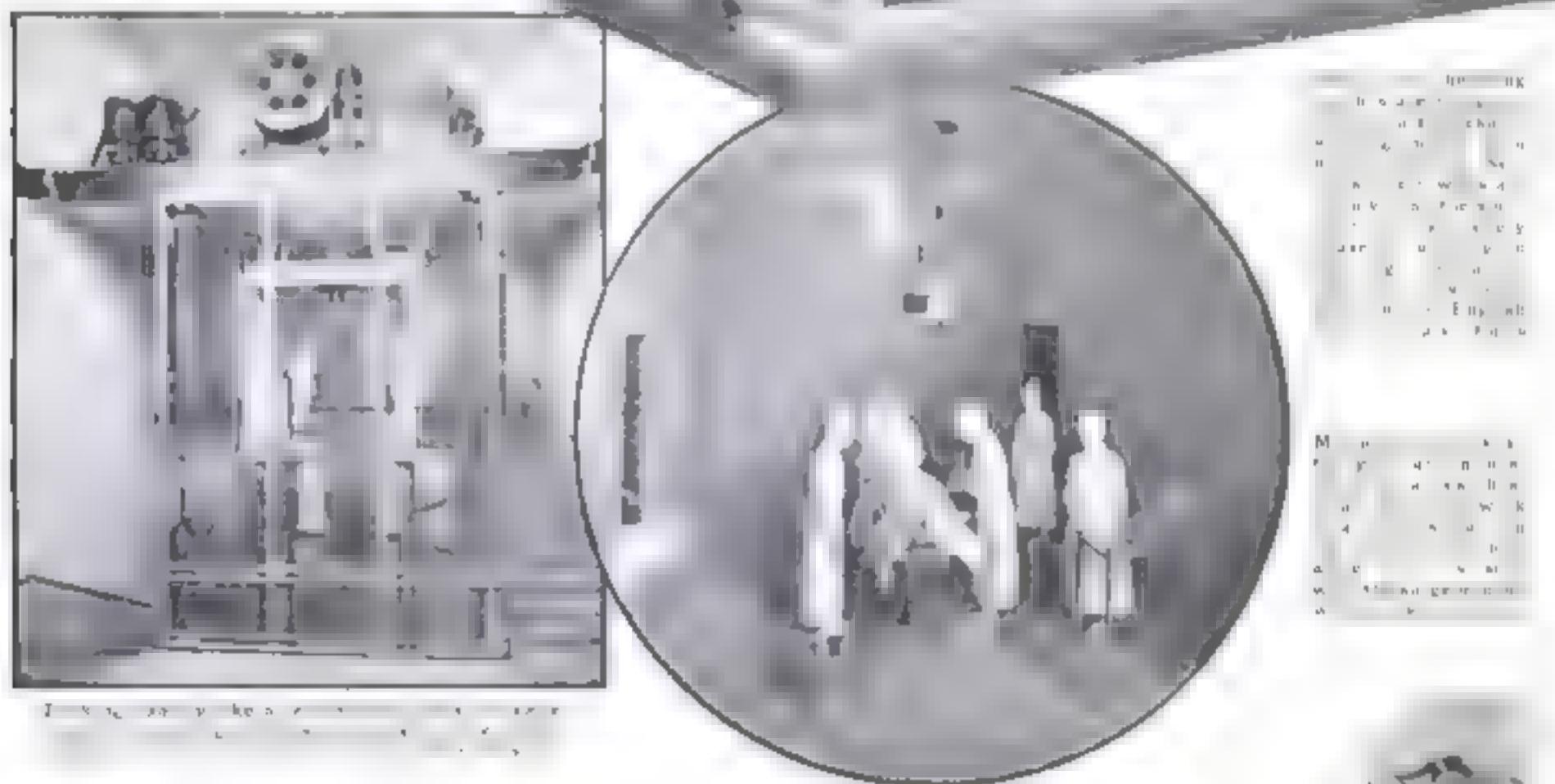
Professional golfer exhibiting the putter with guiding flange, he has just designed

Life in a Hospital Seen in Scale Model

To stimulate contributions to a British hospital fund, sponsors of the drive are exhibiting at London, England, a large-scale working model that is probably without a counterpart in the world. It depicts a modern hospital building, and sections of the walls are cut away to give the public a clear idea of the activities that go on in such an institution. Miniature figures in an operating room show a surgeon bending over a patient, while masked nurses assist him. An electric elevator that actually works is seen running from floor to floor. There is a fully equipped X-ray room to help to show in the time a man he is disabled.

Prominent British firms cooperated in preparing the exhibit and gave hand-knitted garments to illustrate bed-spirals in some of the

beds.



NEW TYPE OF AIR BATTERY

An improved model of the air-breathing A battery introduced to radio fans two years ago requires only a single filling of tap water to put it in service. Reservoirs hold extra water to maintain the level as the electrolyte-forming chemicals dissolve. This precludes damage from neglect of a second filling formerly required. Fuller holes at front make inspection and cleaning easier. The new battery, like its predecessor, absorbs oxygen from the air through carbon "lungs" to destroy electrode deposits and keep voltage constant.



PLUG MENDS PUNCTURE

PUNCTURES in auto tire casings are speedily repaired with a new mushroom-shaped plug of rubber. Smearred with rubber cement, the plug is pushed through the hole from inside as shown above. Its projecting stem is seized from the outside with pliers, drawn tight, and cut off. The tire may be used immediately.

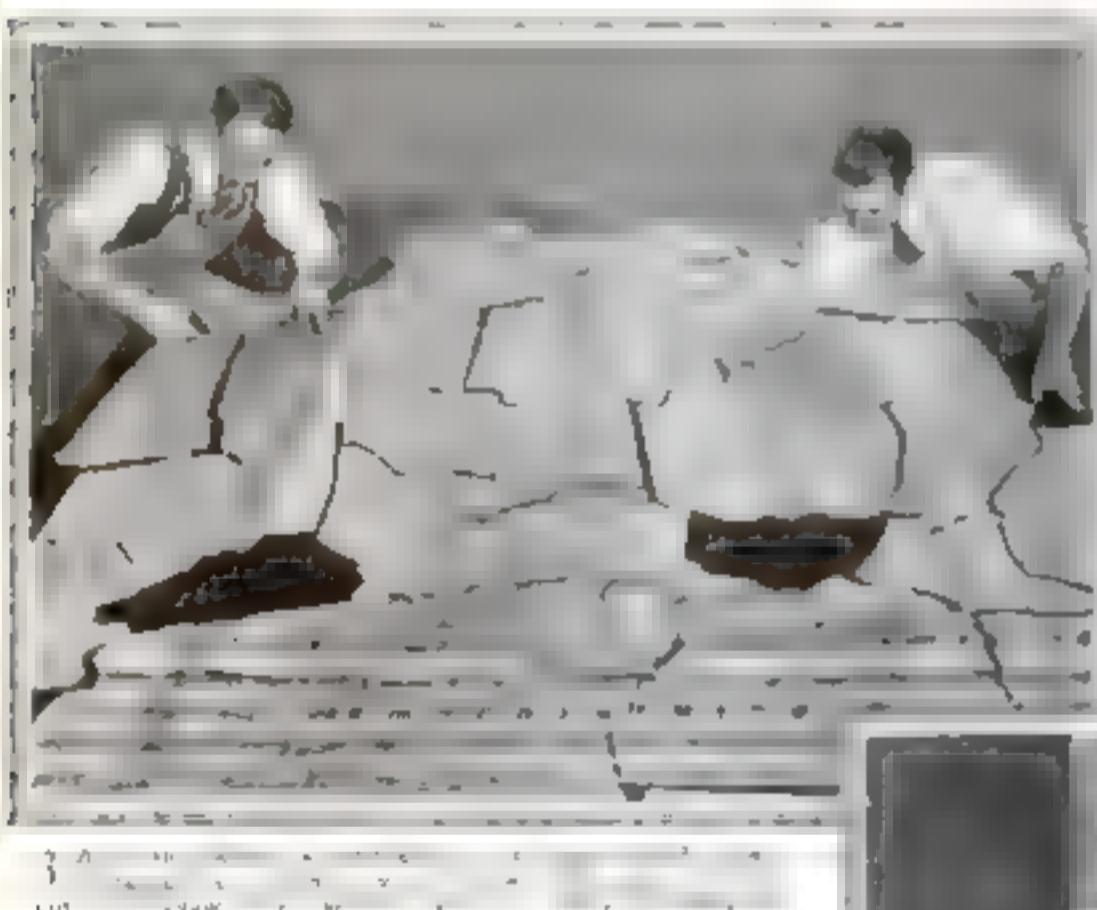
• Beautiful Pictures Built



1 Look at a page from the book "The Wizard of Oz".



2 A man in a suit and hat stands in front of a piano.



3 Two men in suits and hats stand in front of a piano.



4 A man in a suit and hat sits at a piano.



5 Here is the man who made
and has the piano case as
they arrive in his country.
Name who he is made

6 The man who
has the piano
case as they
arrive in his
country. Name
who he is made



with Tiny Bits of Enamel

*Photos on These Pages
Tell How Mosaics Are
Designed by an Artist
and Skillfully Copied*



6 After each section of the mosaic is finished it is laid on the floor in its proper relation to the other sections. When the whole mural is completed, the sections are picked up and taken to the building in which the picture is to remain permanently



7 When installing the mosaics in the wall, the worker presses each section into a bed of cement with paper to determine. A wet brush is passed over the paper and is then drawn off the mosaic

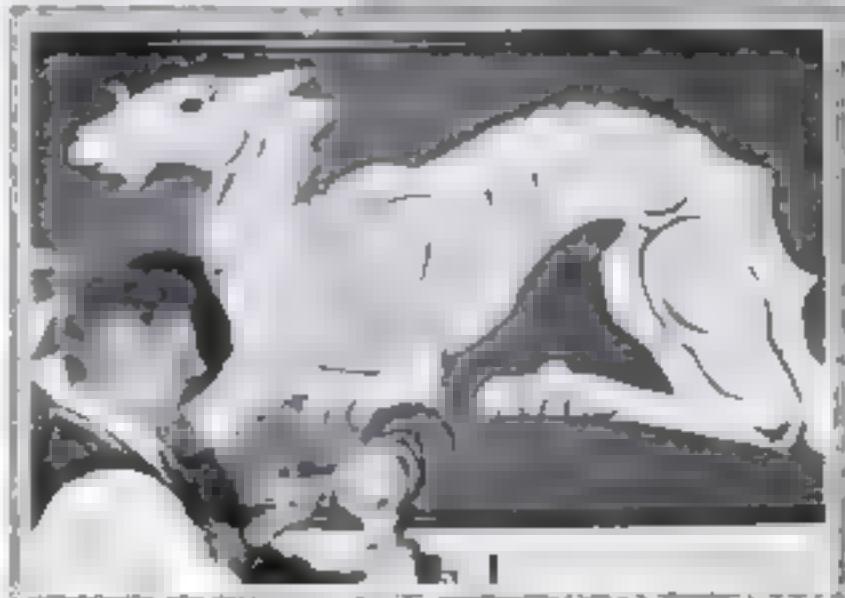


8 At right is one installed section of mosaic with the workman putting the final touches on it. As he slides a wooden block over the mosaic he taps it

MASTER craftsmen in a New York studio, at this writing are fitting together tiny blocks of colored enamel to form a giant panel of mosaic work seventy-six feet long and fourteen feet high. Destined for installation at Radio City, it is considered one of the finest examples of present-day mosaic—an ancient art now being used in the decoration of buildings.

How is a mosaic made? Photographs on this and the preceding page, taken especially for POPULAR SCIENCE MONTHLY at the workshops of Ravenna Mosaic, Inc., and the De Paoli Co., Inc., reveal the steps of the process by which the original design is reproduced in the mosaic.

Contrary to general impression, the blocks composing the picture are not equal in size or shape, but are chipped to the desired form with a hammer and anvil. More than 100,000 pieces have been used in one mural. Two main styles of technique are used, in which enamel and marble blocks, respectively, are the materials.

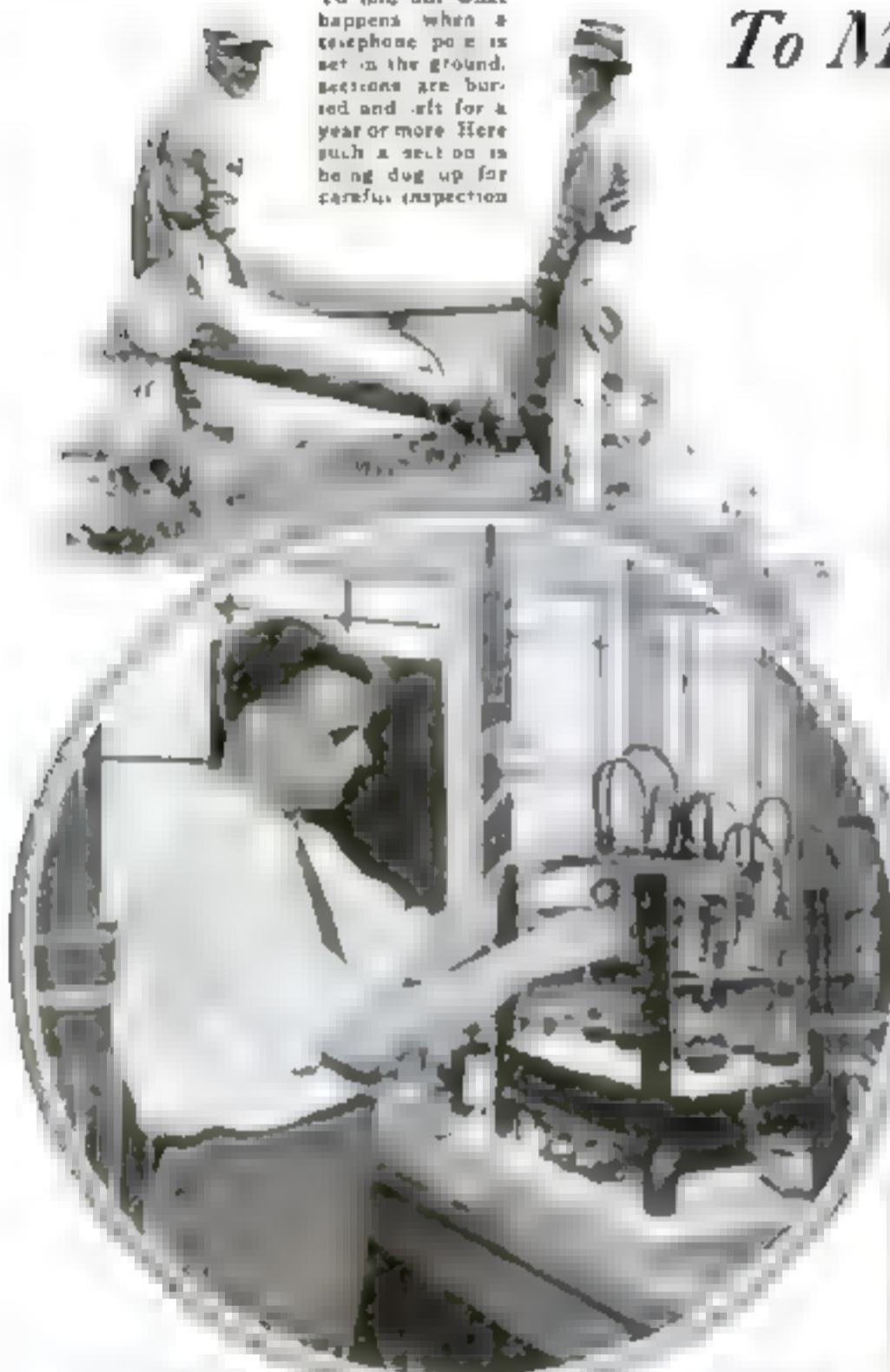


This mosaic, differing from the one above which is of enamel, is of various kinds of marble. It is here being polished which, with marble, is the last step. A high lustre is thus given to the tiny pieces

Bury Telephone Poles

To Make Them Live Longer

To find out what happens when a telephone pole is set in the ground, sections are buried and left for a year or more. Here such a section is being dug up for careful inspection.



Cars are loaded with test specimens of telephone poles, as is shown above, and then moved into the treating cylinder where they are impregnated with creosote which acts as a good preservative.

SHORT sections of telephone poles, coated with creosote and buried in three widely-separated laboratories, are expected to show how poles can be made to last longer. Every year foresters employed by the Bell Telephone Co., bury sections of poles at Limon, Colo., Gulfport, Miss., and Chester, N. J. After a year or more, they remove the logs, cut out their hearts with augers, and study them. They have learned that telephone poles rot because fungi eat the wood. Moisture and warmth speed up this eating. So they introduce creosote into the wood which remains there for several decades despite exposure to sun, wind, rain, and soil moisture. In the three pole-testing grounds conditions are quite different as to soils, climate, wood-eating insects, fungi and moisture. Before cutting down a forest, specimen poles are shipped to the Mississippi laboratory. There they are treated with preservatives. One section of each pole is buried at Gulfport and two others are shipped to New Jersey and Colorado for similar treatment. A year later, the poles are dug up and subjected to scientific tests to learn what changes have taken place.



The photo at upper right shows what is sometimes found when a test specimen of a pole is dug up. This is obviously decayed and the fungi growing within the wood is easily seen. In the circle below, in the treated sections are being added calcium chloride powder.

In the laboratory at right, samples of the poles are being subjected to chemical analysis in an effort to discover what chemical changes occurred while the poles were in the ground.



The lines of poles at top are all test sections set up in the exposure plot at Limon, Colo. Sections of these same poles are also buried at Gulfport, Miss., and at Chester, N. J.



How JIG-SAW PUZZLES

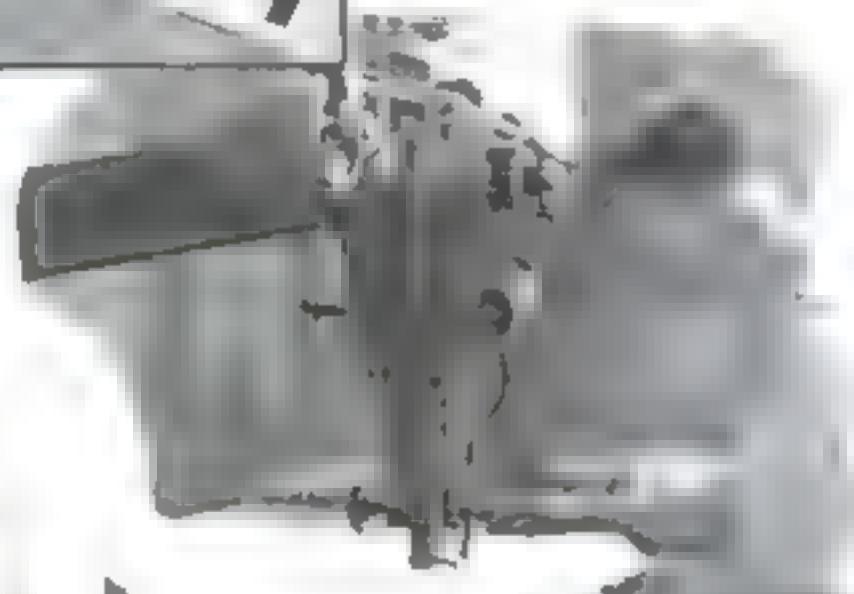
Are Made by the Million

PUTTING jig-saw puzzles together is the latest craze to sweep over America. It has replaced the cross-word puzzle, the Tom Thumb golf course, and in many places has ousted contract bridge. On this page are photos showing the steps in the manufacture of the millions of jig-saw puzzles sold each week.



1 On a block of wood, a drafterman draws the outline of the irregular pieces that later will make up the jig-saw puzzle.

2 As the second step, right, at saw it need to cut out the puzzle in accordance with the pattern already drawn. The cut block leaves much new wood pieces in place.



3 Next comes the job of sawing the steel knives into the design of the puzzle. These are blades that will cut the puzzle into bits as it is when you finally sit down to it.



5 From the press, as the last step of all, the puzzle goes to these girls who break the pieces apart and dump them into a hopper whence they are packed and boxed for every distributing agency.

4 When the cutting knives are in place the die goes to the press a big thirty-ton machine, that stamps out the puzzles. The press is set so the knives do not pass entirely through the cardboard but leave the pieces still clinging tightly together.

Swift Motor Trucks Put

By EARL CHAPIN MAY



While moving rapidly from one stand to the next, circus folk do make-up in their private cars.



Carried in big motor trucks from one town to another the elephants are quickly unloaded as the end of the truck drops to provide a gangway for the naughty pachyderms.

Motorized travel provides circus people with many comforts as is evident from the picture left, of one of the living cars which is equipped with home-like conveniences.

MORE than thirty circuses this spring will tour the country moving from town to town in motor trucks. The American circus began its career on country roads in horse-drawn wagons. Later it took to the railroads. Now it is back to first principles and is taking advantage of the modern truck and the modern highway. In this way it has decreased its expenses and increased its mobility.

Though townsmen, that is, non-circus people, are naturally interested only in the performance and the menagerie, a circus owner is always wrestling with his daily "nut," or overhead. With few exceptions he must move his property six times weekly. Motion is the chief characteristic of American circuses. Such a circus to get into the money, must be getting up and open from early morning until early afternoon. It must be tearing down from 4:30 p.m. until midnight. Between mid-

night and early morning it must be making the jump to another stand. Hence one of its heaviest overhead items is transportation.

A circus must have three rings to attract paying patronage. Americans disdain a one-ring show. Ten seventy-foot railroad cars are needed to transport the smallest three-ring circus. For a minimum run of fifty miles the standard railroad ten-car tariff is \$400. This increases to \$1,200, or more, depending upon the number of circus cars and the distance traveled from one stand to the next.

In addition to this a railroad circus must load and unload in local yards, haul its tonnage to and from the lot over city streets, and pay heavily for the privilege. A big show with which I traveled was shaken down in an Illinois town because its eight-ton baggage wagons cracked some discarded manhole covers.

A motorized circus, paying only for

motor licenses, except where in a few instances special licenses are required, loads on the lot, exhibits, tears down and goes directly to another pitch. Valuable time and money are thus saved.

Speed and economy are two watchwords on a circus. A railroad show speeds into and out of towns and territories. The mechanical problems of the lot are mastered easily. As the veteran circus owner Charles Sparks once told me while we watched his canvas gang pitching his tents in a driving rain at Racine, Wis.: "Any boob can run a circus, but it takes a wise trouper to know where to put it."

Unforeseen opposition, twelfth hour revocation of a city license, overnight visitation of an epidemic, prolonged continuance of a drought or flood may compel a circus to switch or change its routing. A railroad show can do this more or less readily, with the assistance of friendly railroad officials. But it is not so easy to get two or three advance or billing cars which are two or three weeks ahead of the show and a thousand miles away from it, on to a new railroad route without losing much time and motion. Sometimes, from the nature of the contract, it is not possible promptly to switch routes.

A few years ago a railroad circus owned by Fred Buchanan was caught in a hostile squeeze between two older railroad circuses. One of the rival shows was billing ahead, urging townsmen to patronize it instead of the oncoming Buchanan circus. The other was billing right behind, imploring prospective Buchanan customers to wait for the big show coming later. The two opposition shows split the Buchanan towns between them.

Before Buchanan could get free from this entanglement, he had lost a large bank roll. He was on the rails again last year but did his advance billing from more mobile motor trucks, which permitted him to switch his railroad routing more rapidly and profitably.

Two years ago, while Sam B. Dill's

CIRCUS Back on Roads



*Our
Machine Age
Brings
Revolution in
Method of
Moving Tent
Shows in
America*

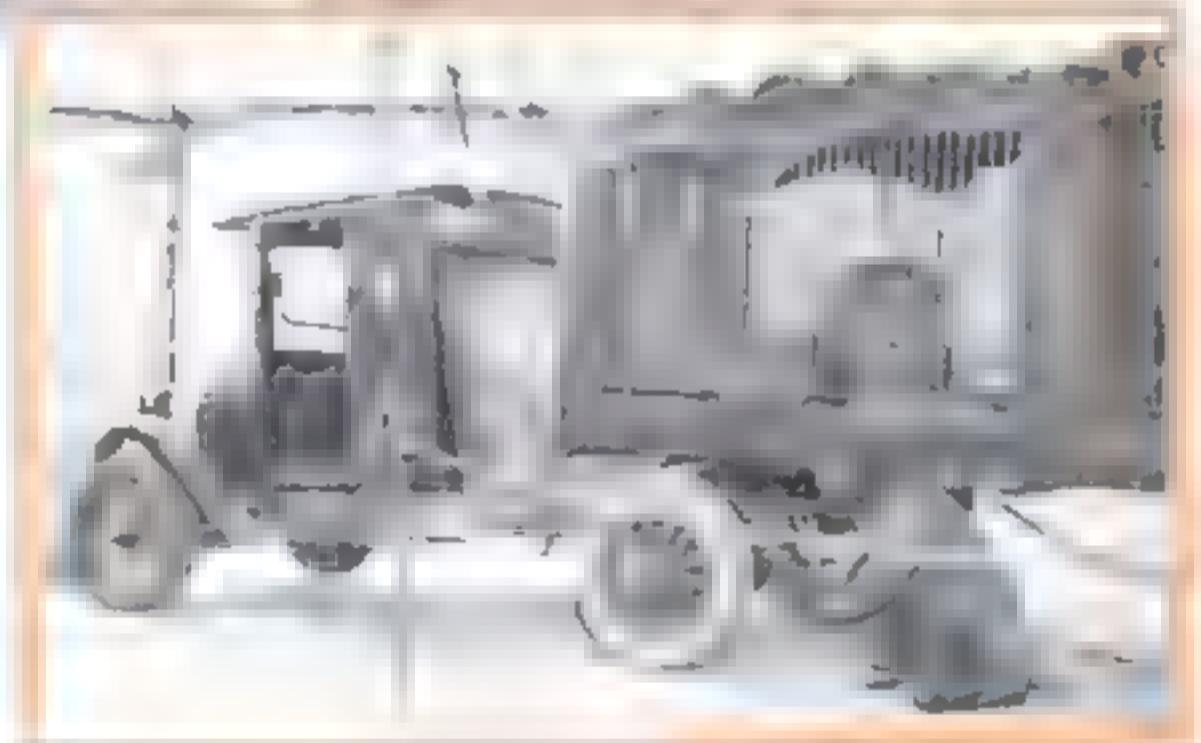
A DILL CIRCUS TRUCK. — Above, a view of the Dill circus truck which has been converted into a mobile menagerie. The animals are shown in the open truck bodies.

DILL'S CIRCUS was working westward when his general agent wired back that expected it had not blessed a drought afflicted route through which the show was routed. Dill wired his agent to switch the route a hundred miles to the south of the stricken land into territory where crops were good. The Dill advance cars, which were motor trucks, picked up the new route in one day, and not a stand was lost because of the slow train.

Prior to the opening of the 1930 touring season Dill, a veteran motor circus owner, was so sold on truck exhibition that he purchased fifty-two motor trucks on what he describes as a live-and-let-live basis which he has never regretted.

Between the opening of the tenting season on April 26 at West Baden, Ind., and the season's close on December 6, at Hollywood, Calif., his circus traveled, exclusively by motor, 14,882 miles. His truck and passenger car equipment was equivalent to a twenty-five car railroad show. The distance traveled compares favorably with a one season's route covered by any railroad show.

Dill made a comparison of transportation cost based on that season's experience. He found that the cost for the daily jump by rail averaged \$905. For exactly the



With the sides of the trucks removed above the menagerie animals are ready for exhibition in the big parades. Below photos show several of the various kinds of big trucks that are used now to move the tent shows over the roads.



same mileage, the expense of moving by motor truck averaged \$225.50.

This saving of approximately \$650 daily or \$3,900 a week is important to a medium sized circus. One twenty-mile mountain

jump in eastern Tennessee, which would have cost Dill's circus \$450 if it had been on the rails, cost him only \$75 in gas, oil, tire, and truck accessories.

There is a further advantage in this type of transportation. After the motorized circus has exhibited, and (*Continued on page 108*)



Instrument used to prevent hemorrhage during stomach operation

VITAL ORGANS *cut from body to work*

Life Saving Miracles

LIFE-SAVING by surgery, the most dramatic phase of modern medicine, now includes the removal of whole organs from the human body. This is one of the most recent daring advances in the technique of the operating room.

Miracles of this kind, performed again and again, have proved you can live without a stomach, with one of your lungs entirely removed, with a kidney gone, and even with part of your brain taken away by the surgeon's knife.

At the famous Mayo Clinic at Rochester, Minn., two years ago, a man nearly seventy years old, had his entire stomach removed. Afterwards, he could eat anything he could before and he could digest it better.

When this elderly patient reached the clinic, an X-ray examination revealed he had a malignant tumor in his stomach. Only the total removal of this organ, the surgeons agreed, would give him a chance to live. During the amazing operation which followed, they first severed the top of the stomach from the gullet, the passage from the mouth to the stomach, and then cut the lower end free from the intestines. Finally, after removing the stomach, they sewed the end of the gullet to a loop of the intestines and closed the wound.

In a few days, he was able to take liquid

nourishment and in a month the patient was consuming solid food.

How could he eat without a stomach? An X-ray picture, six weeks after the operation told the story. The small intestine to which the gullet had been connected, had stretched to accommodate the food and this pouch was taking the place of the lost stomach.

As a matter of fact, the importance of the stomach in the human system is commonly overestimated. It doesn't digest our food. While holding it, it begins the processes of digestion, but it is the small intestine which does most of the work of assimilating nourishment from the meals we eat.

Evidence of this is also found in a unique operation now performed to cure ulcers of the stomach. By sewing a loop of the small intestine to an opening near the top of the stomach, surgeons sidetrack the food. This gives the part of the stomach containing the ulcers a complete rest and the sores are allowed to heal.

One of the most curious operations of which I ever heard occurred in connection with the digestive system. It was performed upon a man whose stomach exploded.

Several years ago, in Chicago, Ill., a young workman was caught between a moving crane and a beam. He had eaten a heavy meal of parsnips and cabbage

and his stomach was distended with gas. While his cries were heard in time to save him from being crushed to death, the sudden pressure upon his abdomen caused an intestinal explosion which tore a hole through the top of the small intestine. He was rushed to a hospital where a surgeon operated immediately, sewed up the hole, and saved his life.

In Berlin, Germany, Dr. Heinz Kalk recently announced the success of a remarkable invention which will enable surgeons to examine the condition of different organs of the body before they operate. It is a minute telescope fitted with a tiny but powerful electric light. The instrument is inserted through the abdomen wall by means of a small opening made in an anesthetized spot. Then filtered air is pumped through a germ-free tube, lifting the wall of the abdomen away from the internal organs so they can be seen when the surgeon switches on the light and peers through the outer end of the telescope.

This method of diagnosis, Dr. Kalk reports, is especially accurate for diseases of the liver, gall bladder, appendix, and stomach. The only organs that cannot be examined by this anatomy telescope are the pancreas and the kidneys. Ordinarily they are hidden by other organs. The air which is injected into the abdomen is quickly absorbed and the small holes



Police surgeon inspects a machine that breathes for patient



Recent Operations of a Sensational Nature Are Described for You in This Article, Fifth in Our Series Dealing with Modern Surgery

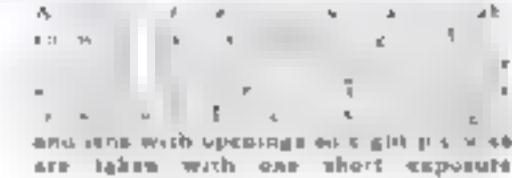
By

**FREDERIC DAMRAU,
M. D.**

necessary for inserting the telescope and the air tube are said to give no trouble.

When accidents paralyze or destroy whole organs or parts of the body, striking emergency operations are sometimes necessary to save the life of a patient.

I remember one dramatic case which saved an orderly in a hospital from starving to death. One sweltering summer evening, he picked up what he thought was a glass of water and gulped it down. It



and lens with openings on a right eye are taken with one short exposure

was a disinfecting solution of lye. The powerful alkali seared the tissues of his throat so badly that the gullet closed in a tight scar. He could not swallow.

Somehow, food had to be got into his stomach. In the operating room, I watched the surgeon make a small opening through the wall of the abdomen into the stomach. Then he inserted a tube and sewed it permanently in place. Through this tube, the man now feeds himself. Although no food ever enters his mouth, he is in good health and is able to continue his work and earn a living.

Not long ago, a business man in Charlotte, N. C., fell victim to a similar accident. For six months, he obtained nourishment through a rubber tube inserted in his stomach. Then the tiny opening down his practically-closed throat was gradually widened by a unique operation which a surgeon had him perform each morning. He swallowed a small metal ball and pulled it up again to stretch the injured membranes. The size of the ball gradually has been increased until the opening is now sufficiently large for him to eat in the normal way.

Even more sensational than either one of these feats was a daring and original operation performed by Dr. Carl Eggers

MUSIC AIDS OPERATION. A specially designed electrical phonograph, left, is demonstrated by Dr. A. F. Eggers & Adam Bronk, surgeon, who developed it to distract the attention of a patient during an operation. The device is made of brass metal. Below it is seen the head bear which is used to anesthetize a patient.



of New York City. One of his patients had a tumor completely obstructing the lower end of his gullet.

Dr. Eggers made an incision in the stomach wall so the man could be fed temporarily through a funnel and rubber tube. Then, he drilled a hole through the upper part of the breast bone and, by a second operation through the back, cut the gullet free above the obstruction and attached it to the hole.

To complete this miracle of human carpentry, he connected the end of the gullet, at the hole in the breast bone, with the opening in the stomach, using a piece of rubber tubing a foot long. This tube passes outside the patient's body in front of the chest. But it is entirely hidden by his clothing so his appearance is the same as that of other men. He chews, swallows, enjoys his food, and can eat anything. Since being fitted with his marvelous rubber food-channel, he has regained his strength and has returned to work.

In England, the famous British surgeon, Sir Arbuthnot Lane, has removed half of the five-and-a-half-foot colon, or large intestine, in an operation for aggravated cases of constipation. Some of his colleagues refer to him as the surgeon who changes the colon into the semicolon.



This is the latest form of art facial typewriter. Words are formed by mouth movements but it comes from the jaws under man's arm

An ingenious device which suggests a snap cuff-link is now frequently used by surgeons to aid in difficult stomach and intestine operations. It is known as a "Murphy button." It saves time and increases the efficiency of the surgeon in joining different tissues. Two button-like plates of metal, each fitted with a hollow stem, are so arranged that when one stem is inserted inside the other and the buttons are pressed together, they snap permanently in place.

I recall one operation in which a Murphy button played an important part. We had to remove fully three-fourths of a patient's stomach, sew the remainder together into a small bag, using fine catgut stitches, and then open a new channel from the stomach into the intestines.

Making a small slit in the side of the stomach-bag, we inserted one-half of the Murphy button and sewed it in place. Next, a similar slit was made in a loop of the small intestine and the other half of the button was inserted and sewed fast. Then the halves were clasped together bringing the opening in the stomach and the slit in the intestine snugly in place. Quickly the tissues were sewn together over the button, providing a new channel for the food. In a few weeks, these tissues had grown solidly together and the Murphy button, no longer needed, was passed off by the body.

Sometimes an organ in the body turns traitor and has to be removed. One such perverse part of the human anatomy is the spleen, regarded by the ancients as the seat of bad temper. Hugging the lower ribs, on the left side of the abdomen, it acts as a storehouse for broken-down red blood-corpuscles. The life of a blood cell is about twenty days. When it is worn out the remains act as a poison to the body unless they are removed. The liver

turns them into bile which is poured from the gall bladder into the small intestine where it acts as an antiseptic and also aids in digesting fats. The spleen takes care of the surplus dead cells which the liver cannot turn into bile.

Occasionally in some mysterious way it runs amuck, killing red corpuscles and destroying the power of the blood to clot. As a consequence, the afflicted person may bleed to death from a simple scratch.

Last year, a man fifty years old was brought to St. Luke's Hospital, in New York City. He was white as a ghost from loss of blood. Transfusions failed to stop the internal hemorrhage which threatened his life. Blood in his body simply would not coagulate.

In the operating room, Dr. Edward J. Donovan, the surgeon in charge, opened the abdomen an inch or so below the lower left rib. He could see the spleen distended to twice its normal size. It was the trouble-maker. Prying the organ loose from its attachments, he clamped the arteries and veins leading to it and then cut it free, afterwards tying the severed arteries and sewing together the abdominal wall in layers.

Six hours after the operation, tests proved that the man's blood was again clotting satisfactorily. By removing a whole organ from his body, his life had been saved.

In another case, Dr. Donovan operated upon a baby, ten months old, removing an enormous spleen which weighed one-fourteenth as much as the child himself. It has been found that when the spleen is removed its functions are taken over by the small lymph glands distributed throughout the body.

An axiom of surgery used to be, Leave the tube carrying bile from the liver to the intestines alone or the patient will die. In defiance of this axiom, Dr. Goder L. McWhorter, of the Presbyterian Hospital in Chicago, performed a sensational operation that saved a woman's life.

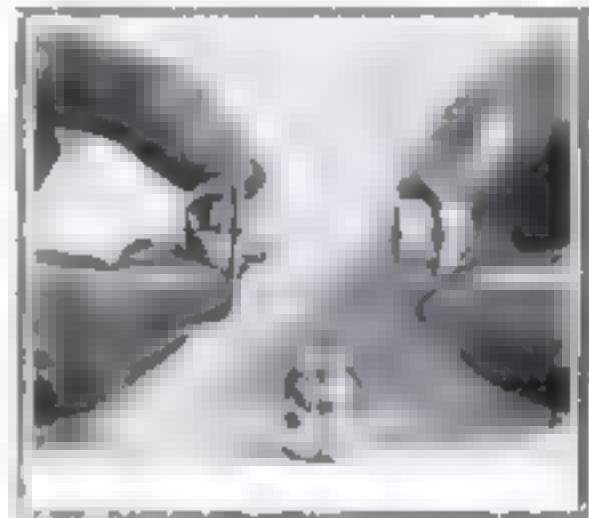
He found that her bile tube was diseased and completely obstructed. She was already the color of bronze from prolonged jaundice. Her chances of recovery appeared slim. A less courageous surgeon would have declared the case hopeless and death would have been inevitable. But McWhorter played a long shot and won.

He cut out both gall bladder and bile tube and then created a new passage for the bile by hitching the thin duct coming from the liver, which ordinarily carries the bile to the gall bladder, to the intestines. This artificial passage functioned perfectly. Eight years later, when the surgeon saw the woman again, she was in excellent health.

Another axiom of the medical books concerns the skin, which, with its many functions, is actually an organ of the body.

"Lose a third of your skin," it declared, "and you lose your life." Recently this belief was upset by the strange case of Loby J. Doty, of Memphis, Tenn.

Doty started on a fishing trip with two companions. The car in which they were riding overturned, exploded, burned his companions to death and seared more than



These two views show the "Murphy button" before and after the halves are snapped together. The button is used to join severed tissues or to unite stomach to intestines

a third of his skin from his back and legs. To keep the raw flesh from getting chilled doctors placed him in a sheet-iron oven kept at a constant temperature of 103 degrees F. by four large electric bulbs. For 412 days, Doty lay face downward in this metal heater. His arms and head projected so he could read and play cards to amuse himself. At the end of his long imprisonment in the oven, his seared flesh had cleared up, new skin was grafted on the burned areas and his remarkable recovery was complete.

Not infrequently, nowadays, when a kidney becomes diseased it is removed.

An author friend of mine has been getting along on one kidney for years. He works ten hours a day and drives on it. In some brazen operations, which will be referred to in the next article of this series, I have seen as much as a handful of brain matter removed by the surgeon from within the skull of the patient who made a complete recovery. Similarly, complete lungs are now removed on the operating table to save lives in desperate cases.

The fact that a person can walk the streets well and happy with only one lung is made use of by surgeons in treating certain cases of advanced tuberculosis.

I remember one instance which occurred under unusual circumstances. A star athlete had just crossed the finish line a winner in the 100-yard dash, when he fainted and (Continued on page 105)

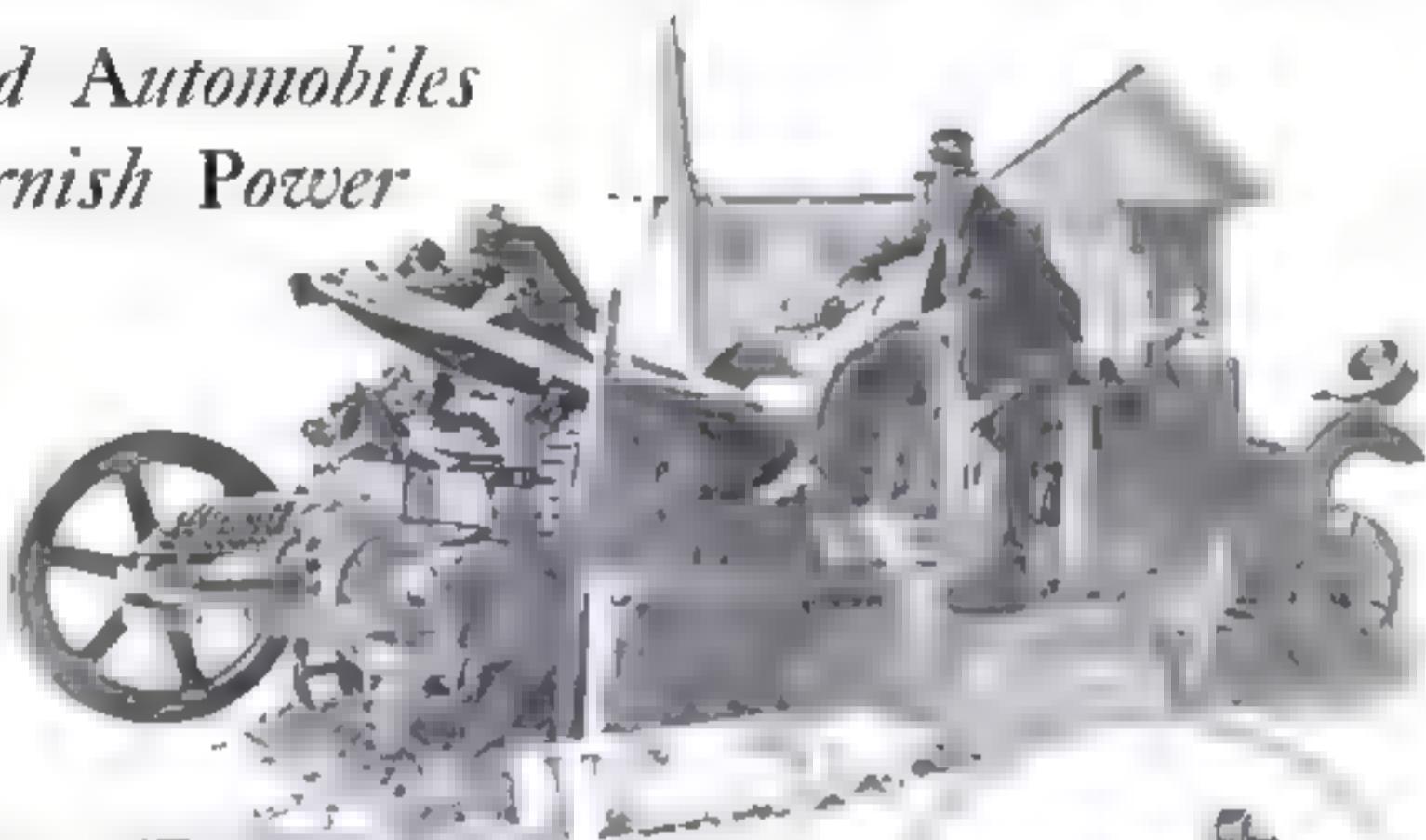


Bloodless surgery is possible with this radio knife which is being used to decompress the removal of a mole. Note the battery connection on the left arm and the metal tip on the knife. When point touches the skin, a circuit is formed

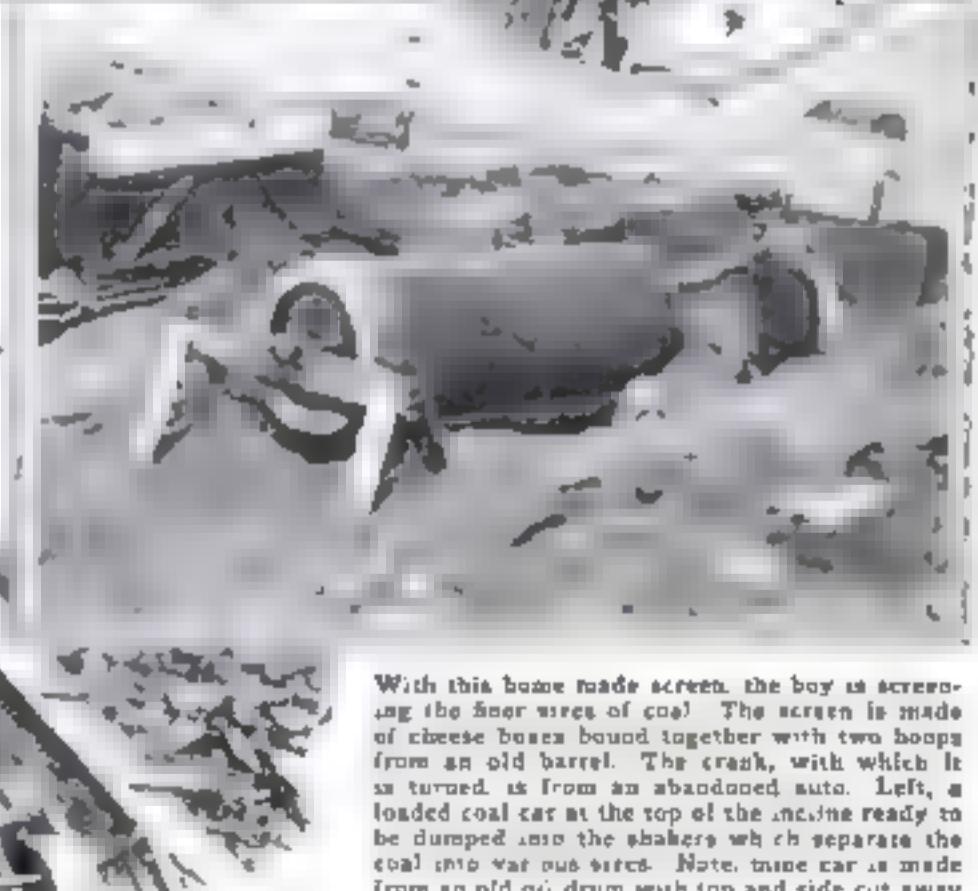
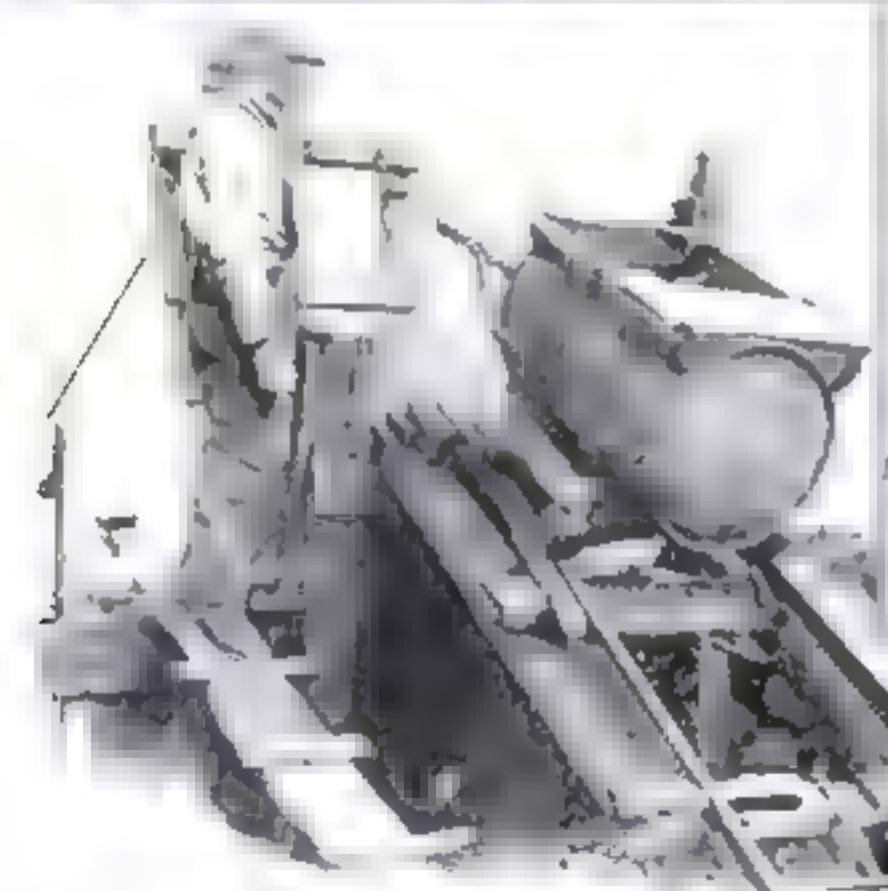
Emergency Coal Mines

Use Old Automobiles to Furnish Power

Out of work and having to remain idle men in Peoria, Illinois have formed small groups and are working coal mines on their own, selling the output in neighboring towns. To supply the necessary power they have rigged up old automobiles. The one at the right, painted on a shaker, is used to sort coal.



Not only is the auto, left, a power plant by means of which the loaded coal car is dragged out of the mine, but when the drum on the rear wheel is removed, it carries the miners home. At right, a general view of breaker and plane with a loaded coal car at the top.



With this home made screen, the boy is screening the finer sizes of coal. The screen is made of cheese boxes bound together with two hoops from an old barrel. The crank, with which it is turned, is from an abandoned auto. Left, a loaded coal car at the top of the incline ready to be dumped into the shakers which separate the coal into various sizes. Note, this car is made from an old oil drum with top and side cut away.

Food for Cattle Grown in Metal Cabinet

A synthetic compound in a sterilized cabinet seven feet high, and reported able of supplying cattle green herbage, a herd of cattle has been developed.

In ten days ten drawers which tender maize plants sprout, their growth being accelerated by use of a special solution of stimulating chemicals.

Early Ten days the plant is carpeted with

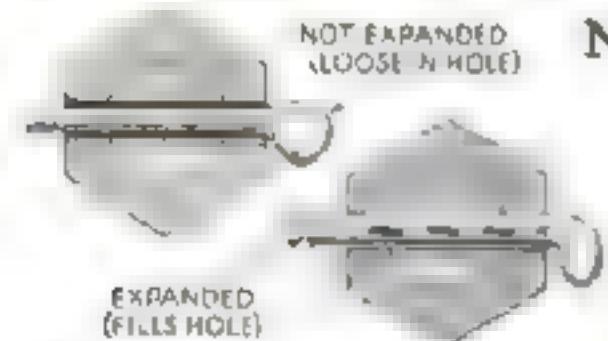


CLOSED CAR WINDOW IS OPENED BY A LEVER

A new window control has been designed by two Eureka, Calif., inventors to aid the driver of a closed car in making hand signals. A flip of a convenient lever allows the window to drop open of its own accord. Only three-quarters of a turn on a crank handle is required to raise the window again and shut it tightly. The panel may be stopped at any desired position, and will not creep or drop until released by the lever.

CORN LEADS AS MOST VALUABLE U. S. CROP

WHAT are the ten most valuable crops raised on American farms? The United States Department of Agriculture recently answered this question from statistics compiled during the latest census. They are, in order of their value, corn, hay, cotton, wheat, oats, potatoes, tobacco, oranges, barley and apples. Ranking just below the ten leaders come, in order, sugar beets, tomatoes, dry beans, grapefruit and sweet potatoes. New uses for leading crops are being sought.



TEETH ON COTTER PIN HOLD IT IN PLACE

To overcome the necessity of expanding the ends of a cotter pin in order to make it stay in the hole, an inventor has designed one providing with ratchet teeth. The pin is inserted in the nut in the usual way. In tapping the head with a hammer, one part of the pin is caused to slide on the other. This expands the pin, as shown above, tightening it in the hole.

BLAME DAM FOR QUAKES

DAATING the Zuider Zee has produced earthquakes in Holland, according to Prof Otto Brasch, of the University of Berlin, Germany. He says recent tremors are due to the dam that cuts the North Sea from the Zuider Zee.

NEW TOOL SPLICES LIVE WIRE

Mechanical hands now enable linemen to repair high tension wires carrying as much as 600,000 volts, without the necessity of shutting off the current while they are working. A veteran California lineman, Chester Coons, is the inventor of the new hot-wire tools. By means of their clamps, hooks, and adjustable wrench openings, the workers can join wires, tie and untie insulators, and tape joints while standing at a safe distance from the live cables. Each tool has a six-foot handle of Philippine mahogany. The wood is chemically treated to insulate it. Recently the mechanical hands were used when a 125-mile high tension line was changed.



Using a mechanical hand, these linemen are repairing a live wire without shutting off the current. Photo left shows how clamp, hooks and wrench are used to splice a high voltage line.

Beam of Light Carries Music

*Powerful Ray Speeds Radio Program
Across Half-Mile of City Buildings*



SENDING. From a window in the Chrysler Building, New York, the 50,000-candle-power beam of the light carried music to a broadcasting studio half a mile away.

RADIO fans witnessed a twentieth-century marvel the other night when they listened to a radio program transmitted over a ray of light.

High in the tower of the Chrysler Building, in New York City, an orchestra played before a microphone. No land wire linked it to the broadcasting studio half a mile away. Instead, the blue beam of a 50,000-candlepower searchlight sped the music across intervening rooftops. At a studio window, a big lens caught the beam and concentrated it upon a photoelectric cell so that the music could be picked up and put on the air so clearly was the program received that many broadcast listeners were unaware of its unusual method of transmission.

Using a ray of light as a telephone wire is not a new idea. John Belamy Taylor, General Electric Company pioneer in exploring its experimental possibilities, talked in this way from the airship *Los Angeles* to the earth, and, more recently, transmitted voices to Schenectady, N. Y., from a mountain top twenty-five miles away. Until now, however, light-beam telephony has been virtually a laboratory plaything. A new system that made its debut in the recent radio demonstration promises to make it commercially useful.

How can you talk over a light beam? Simply by devising a way to make a lamp flicker in unison with the fluctuations of



This front view of the searchlight shows the electric coil with lamp inside it. A close-up of the lamp is above searchlight.

your voice. Then a photoelectric cell within the lamp's range will serve as a receiver, the light pulsations being converted into electric impulses and made audible through a loudspeaker. The talking ray can be aimed squarely at the receiving station so that no one outside its path can intercept its message, and can even be made invisible for secret messages in wartime.

The main problem of experimenters has been to find a light sufficiently responsive to go on and off as many as 10,000 times



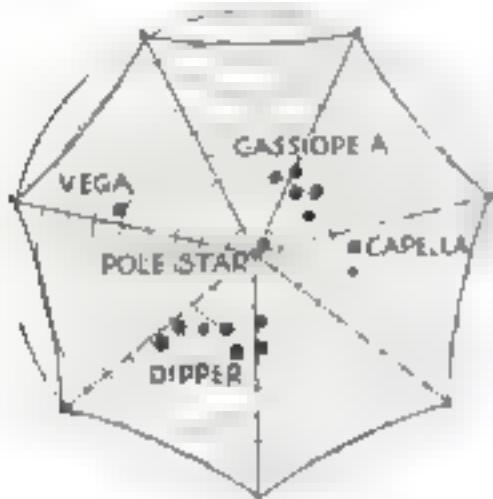
RECEIVING. Here is the lens that concentrated the searchlight beam upon the photoelectric cell, lower right, which in turn converted the light waves into electrical impulses and thence to sound waves.

a second (a necessary speed to make speech or music sound natural) and still brilliant enough to be projected great distances. Neither neon glow lamps nor arc lamps, which have been tried in a microphone-and-amplifier circuit, have combined ideally these absolutely essential qualities.

Now the long-sought light source appears to have been found, in a remarkable wireless lamp perfected by Elman B. Myers, radio engineer and inventor. It is an oddly-shaped quartz tube about eight inches long, to which no electric wires are connected. When the tube is placed inside a high-frequency electric coil, a thimbleful of mercury within it turns to vapor and emits a dazzling blue light that may be flashed on and off at least as many as 400,000 times a second! Mounted in a searchlight, as in the radio test described, the beam of this lamp carries for five miles; and more powerful lamps of similar design are expected to increase the range to forty or fifty miles. The system permits communication by day or night, regardless of rain, snow, or fog, according to J. L. Cassell, chief engineer of the New York firm developing it. Its first commercial trial is scheduled for the end of March when an attempt will be made to talk to an incoming liner.

Learn to Know the

... This Is the First Article of an Unusual Series That Will Reveal the Secrets of the Sky



With a few new stars marked on the inside of an umbrella it is easy to get the sky in motion by swinging the umbrella to the left. The diagram will help you place the stars on your map



HOW TO MAKE STAR TRAILS WITH YOUR CAMERA

Point camera at the polestar. Focus for infinity. With lens wide open, expose to 1/2 hour and the stars will record their paths as shown at left.

Great Bear, Orion, Perseus, the Lion, and so on—are just as distinctly bounded on the sky map as are nations on earth.

Places in the sky lands are located by a kind of latitude and longitude. Only through becoming thoroughly familiar with the geography of these sky countries, or constellations, can you find with a telescope the many breath-taking sights that will delight you when you do acquire a glass of considerable powers.

The trouble with most star maps and charts is that they try to represent the curved, hollow bowl of heaven on a flat piece of paper. Another difficulty is that the beginner is confused by being shown the position of too many stars at first.

Fortunately both these difficulties are easy to overcome with the aid of an object that everybody possesses—an old umbrella. What could be simpler than to let the inside of the umbrella act the part of a miniature sky—and to indicate upon it, with white paint, the positions of the principal stars and star groups as fast as you identify them?

You will need to mark less than a dozen and a half stars in your umbrella-sky to start with. All the other important ones can be found from these. If you take a few starlit walks with your old umbrella in hand, and a flashlight and a piece of white chalk in your pocket, you will soon have a sky-map of your own making, that will show all the principal constellations. As you find new star groups, you can

THOUSANDS of people find astronomy the most fascinating of hobbies, and thousands more would join the fun if they were not held back by the belief that nothing worth while can be seen or done without first securing an expensive telescope.

When you see pictures of the latest giant telescope it is natural to suppose that any stargazing you could do with a field glass would be futile.

But it isn't. It is still possible for amateurs to make important discoveries. A few years ago an English clergyman was given the Royal Astronomical Society's medal for discovering a new star. He had found it with a pocket spy-glass of only ten power. More recently, a vegetable gardener in California had a comet which

he was first to discover named after him. Many of the great discoveries in astronomy were made with the simplest of apparatus or with none at all. Galileo Galilei discovered the moons of Jupiter, the crescent of Venus, the rings of Saturn, and the spots on the sun with a home-made telescope hardly stronger than a ten-power modern field glass.

As a matter of fact, the best way to start stargazing is by using the naked eye for you must first learn what the maps of the starry countries look like before you can explore them intelligently in detail with a glass of any kind. You have to know where to look for China or Russia on the globe before you can find the exact location and surroundings of Nanking or Leningrad. This comparison isn't far-fetched, for the countries of the sky—the

Stars with an Umbrella



With the camera pointing almost directly upward, this picture was made. Note that star lines are straight.

mark them on the right of the plastic with chalk dots, and later make them permanent with a small brush and thick white water color paint.

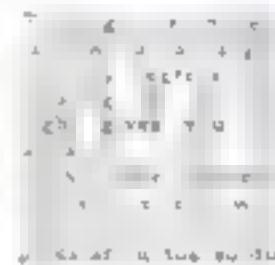
The inside of the umbrella in the photograph at the head of this article, shows the position of the stars you had better mark to start with. Take your white water color and mark them now as near as you can to the positions shown in the small map of the umbrella on the opposite page. The scale to which this diagram is drawn is one-half inch to the foot.

EACH of the circles in the diagram (about arcs of circles in photo) indicates a distance of ten degrees along a meridian of the sky—represented by a rib of the umbrella. Note that there are nine divisions between the pole and the sky's equator (the edge of the umbrella). My umbrella has twenty-four-inch ribs and the divisions are two and a quarter inches.

Before you start out to locate these first stars in the outdoor sky itself, and to find others from them, there is an interesting experiment you can try with the umbrella as it now is. It will give you a good idea of the apparent movements of the heavenly bodies.

Hold the umbrella over a small table with the rod at a slant of about forty degrees, a little less than halfway between horizontal and vertical. Place your eye close to the near edge of the table and look up along the umbrella rod. The point where the rod goes through the umbrella fabric will then represent the North Pole of the heavens. The white dot nearest the rod represents the pole-star. Note that it is not exactly at the pole, but a little off the exact center of the northern sky.

If you look at the far edge of the table, you will see that a part of the sky goes down out of sight behind the table. Call the far edge of the table the northern horizon of the earth, the right edge the



eastern horizon and the left edge the western section of your sky line.

Then rotate the umbrella by its handle, meanwhile maintaining the forty degree slant of the rod. You can tell when the slant is right by watching the short parallel lines as they approach the far table edge below the pole. Four of the short lines should be seen above the table, the rest should be hidden.

Turn the umbrella opposite to the way your watch hands go. This direction is called counter-clockwise. As you rotate the umbrella top, none of the stars you have painted should disappear below the table top horizon with the exception of Vega. This star should go out of sight for a few inches of its circular course after approaching the horizon near the northwest corner of the table top.

THE rest of the sixteen stars you have plotted with white paint belong to the group of constellations that never set below the horizon in their circular march round the polestar. (This applies to any place in the latitude of New York City. North of this parallel of latitude more stars never set, farther south, more stars set below the horizon edge.)

The inside of the rotating umbrella top represents the northern half of the sky in its apparent motion from the eastern horizon to the western. We say apparent because the sky of course does not move. It only appears to do so because the earth is constantly turning the opposite way from west to east.

If you would like to demonstrate the

By GAYLORD JOHNSON



actual rotation of the earth and the apparent rotation of the sky in a much more beautiful and interesting way, you can try the following experiment.

AFTER dark on a clear evening place your camera on a tripod at an open window facing north. Point the lens upward until you can locate the polestar in the center of the ground glass or finder. Then focus for infinity, open the iris diaphragm as wide as it will go, set the shutter for a time exposure and open it. Leave the camera with the shutter open for six hours if possible.

After closing the lens and developing the film, you will find that the stars around the pole have traced many arcs of concentric circles upon the film. If you have left the lens open for six hours, all the arcs will be quarter circles, for the earth, carrying your camera, has turned a quarter way around in that time.

To vary this experiment, place the camera with its lens pointing upward toward the equator of the sky. For the latitude of New York, it should face southward at an angle of about fifty degrees. The picture taken in this position will show the star trails at the equator of the heavens as straight lines, not as circles. You can see why this is by looking up at the ends of the umbrella's ribs as they pass above your head in the first experiment. The little knobs on the ends of the ribs travel along the equator of your position in a straight line.

There is still another interesting experiment which (Continued on page 110)

FUTURE HOMES may have only butler rooms, we are told, like those shown here. Considered a lamp is visible at the top of the wall. It is to be used only when it is dark. By day it has no light. By night it will be lit. In addition there are other useful novelties. The butler's room will be like a radio room, so he may glow lamp for news. I seen him obtain a newspaper from N. W. newsman him. Please tell me the new



Glow Lamps



Night view of the north approach of the Hall of Science at the Chicago World's Fair. The lighting effect is obtained with gaseous tubes



Glow tubes for home lighting are here set in a synthetic window. In use, they would be hidden by a translucent screen through which the light would come at daylight from the north

FROM a fixture on the wall of his laboratory a New York chemist recently removed the electric bulb that had been burning there. In its place he screwed a midget, candle-shaped device resembling a radio tube of odd design and snapped the switch. Several seconds passed. Then spectators saw a glow of soft, diffused light come from the tube. There was no glare, yet the mysteriously bright radiance of the tube seemed to pervade the entire room. Years of effort had succeeded in applying the principles of neon advertising signs in what many believe to be the first practical glow lamp for the home.

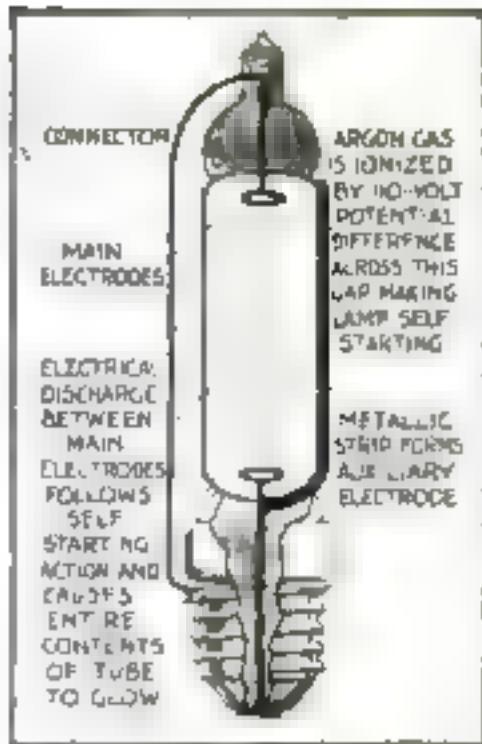
New lamps for old! That is the promise of engineers who, in a dozen laboratories scattered through the country have quietly been laying the groundwork for a revolution that may eventually banish

fashioned, wasteful carbon-filament bulb of a few years ago. So why change?

The truth is that the incandescent lamp is still far more efficient as a heating appliance than as a source of illumination. More than ninety percent of the electric energy it consumes, and for which the user pays, is wasted in the form of heat. This waste is inherent in its method of producing light—heating a metallic filament to the point where it becomes white-hot. Engineers seeking more efficient lamps perceive the necessity of trying new fields, for, as a research engineer for one of the country's largest electrical firms recently said:

"We believe that the incandescent lamp as it now exists is not capable of radical improvement!"

The answer is the glow lamp—a miniature counterpart of the neon advertising sign, from which it has been developed and especially adapted to the home. It has no filament, and produces light by a principle unlike that of the incandescent bulb. Essentially it is a tube of glass or



WHY NEW TUBES GIVE OFF LIGHT

This drawing shows the construction of the glow tubes and exp and the manner of the self-starting. At right Dr. Berhard Branner demonstrating a lamp using new tubes.



Below: A sodium-vapor lamp being used to illuminate a scene. The lamp is shown with a white glass globe.



for Home Lighting

By ALDEN P. ARMAGNAC

juncts, containing rarefied gas which becomes self-luminous upon the passage of electric current through it. The color of its light is characteristic of the gas that fills it; neon gives a red light, a mixture of neon and mercury vapor gives blue, and sodium vapor a bright yellow, while white light has been obtained by a mixture of vapors or by using lamps of several colors together. Upon the particular gas used depends, also, the lamp's efficiency. It may reach surprising figures—as much as two or three times that of an incandescent bulb.

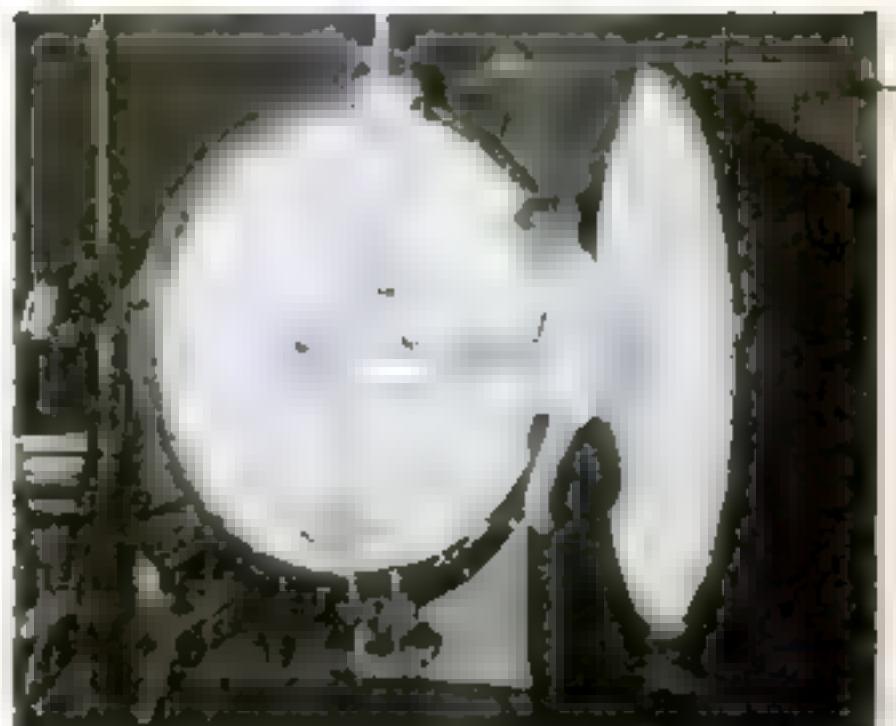
That means that some day you may light your home with glow lamps at a fraction of your present lighting bills. And this is only part of the story. The glow lamp emits so soft and diffused a light that you may stare at it without eye strain or momentary blindness. Since there is no filament to break or burn out, a glow lamp will burn steadily for 4,000 to 6,000 hours—many times longer than the average incandescent bulb.

When glow lamps are first introduced to the public, they probably will be used simply to replace incandescent bulbs in wall sockets, bridge and table lamps, and ceiling fixtures. Once they are accepted and their advantages are appreciated by a majority of home owners, however, they will enter a second phase of development. Architects planning new homes will make the most of their alluring possibilities.

Modern as chromium metal and setback architecture, practical as stainless steel, the lamps are expected to open new

possibilities in the illumination. Walls may be painted in living light instead of hung with decorations, since the new lamps will have no limitations in size, shape, or color. Ribbons and panels of glowing hues may grace the living room or study. It is possible to imagine a home owner blending the colors in a room to suit his mood, by twisting a knob like a radio dial. A preview of these decorative possibilities of glow tubing is provided on the exterior of the Hall of Science Building at the World's Fair in Chicago, where nearly a mile of tubing, the largest installation ever made upon a single building, floods the walls with tints of blue, green, and red.

Imitation windows set into the walls of homes of the future, and lit by concealed glow lamps, will fill a room with soft, artificial daylight. The synthetic sunshine will contain invisible ultra-violet or health rays. This is no flight of fancy; synthetic daylight today lights the interior of an ultra-modern windowless factory at Fitchburg, Mass., where it has proved thoroughly practical. In a home, an imitation window with a painted



With this apparatus the brightness of the new sodium-vapor lamp is measured. It is efficient and much stronger than a common bulb.

landscape may replace an unsightly outlook, and give healthful sunshine twenty-four hours a day if desired.

Already glow lamps have been experimented with for illuminating offices, and have been installed in a few large residences in this country, where they are used, at present, mainly for decorative effects. Their wide domestic use has been delayed while engineers wrestled with what seemed, at first, a hopeless array of problems.

For use in the home, glow lamps must work successfully on ordinary house current of 110 volts—the high-tension current of 2,500 (Continued on page 107)

Living GERMS from other worlds...



In a fragment of the Modoc meteorite, at above Prof. Lipman found living germs. In the circles, right are two microphotographs of these germs, magnified 1,750 times. They are believed to be forms of life carried to earth from outer space.

SPELLED OUT at a microscope, Prof. Charles B. Lipman, University of California biologist, recently gazed at what he believed to be the first living creatures from another world ever observed. Tiny germs—some round, some rod-shaped—swarmed beneath the lens. Despite their minute size, they were as fascinating to a scientist as any hypothetical man from Mars.

If Prof. Lipman has correctly explained the germs' origin, they came to earth carried by a flaming meteorite from the voids beyond our planet! Here, after centuries of speculation, seems the first credible indication that life exists outside the earth.

To test the possibility that living things might exist in other worlds, Prof. Lipman acquired a number of stone meteorites that

By
*Robert E.
Martin*

had fallen on the earth. He proposed to grind these to powder and drop the powder in suitable culture media to see whether germs would grow. If so, evidence would be strong that the germs had survived the cold of the journey through space, the heat of the flaming meteor when it struck the earth's atmosphere, and the years the meteoric stone had rested on the ground or in a museum case. Of course it would be necessary to take extraordinary precautions to

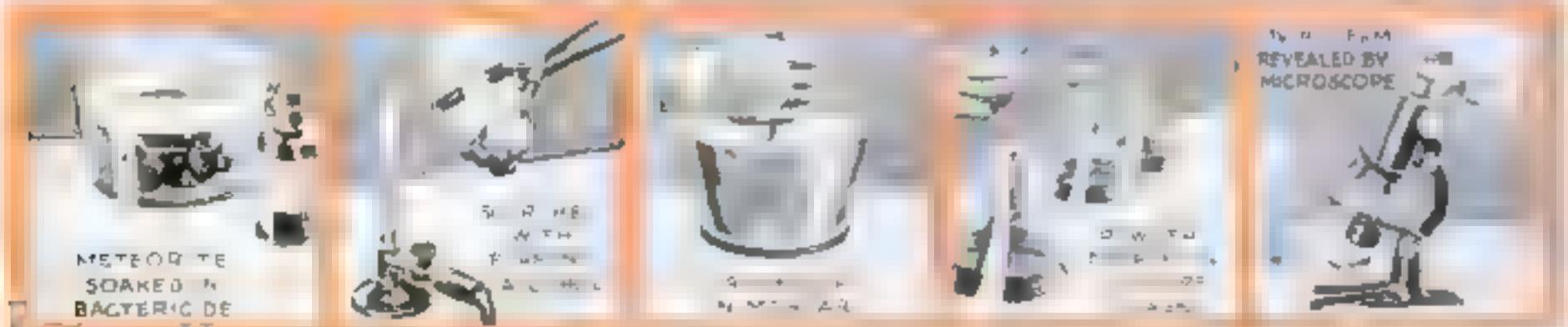


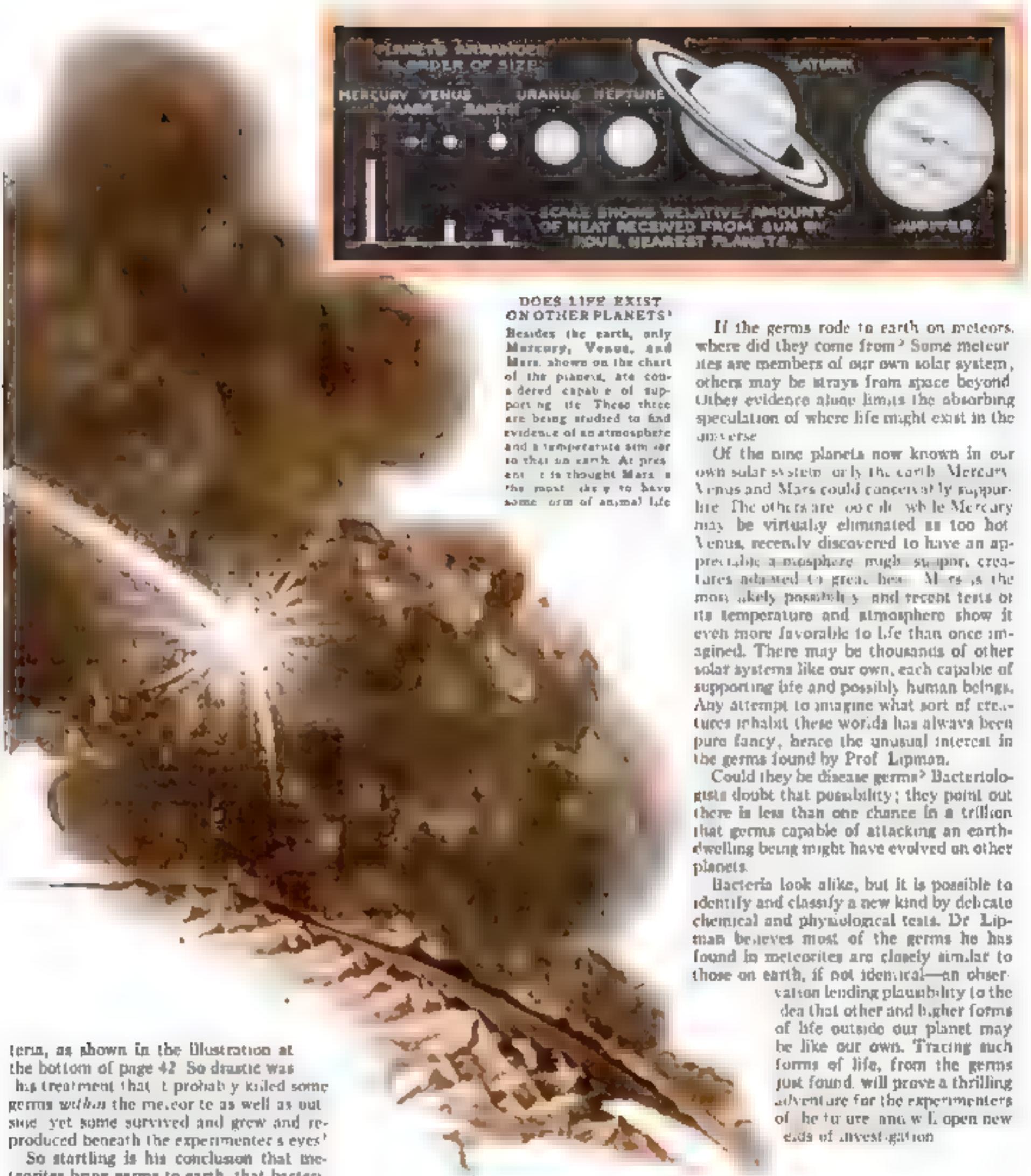
"Meteorites bring with them bacteria from somewhere in space," was the conclusion of Charles B. Lipman, above, after he had made the tests described here.

make sure the meteorite was uncontaminated by bacteria from the earth.

Wearing cheesecloth masks, like those used by surgeons, Prof. Lipman and his helpers sterilized their instruments and at each succeeding step took elaborate precautions to guard against earth-born bac-

By treating the meteorite as shown below, Prof. Lipman destroyed earth-born bacteria and found germs from other worlds.





teria, as shown in the illustration at the bottom of page 42. So drastic was his treatment that it probably killed some germs within the meteorite as well as outside, yet some survived and grew and reproduced beneath the experimenter's eyes!

So startling is his conclusion that meteorites bring germs to earth, that bacteriologists cannot accept it until it is verified by future independent investigators. Doubts have already been raised. Yet Prof. Lipman himself answers many of them.

A flaming meteor may remain cold inside during its brief plunge to earth so germs within it might survive, that they can survive passage through the extraordinary cold of outer space is also known, since recent tests at the University of Toronto showed germs could live after weeks of exposure in liquefied helium to a temperature of 450 below zero. Possible contamination from the soil? Some of the meteorites were picked up sterilized immediately after landing upon our earth.

*...brought to Earth by
METEORS*

MODEL OF DIVER IS FULLY EQUIPPED



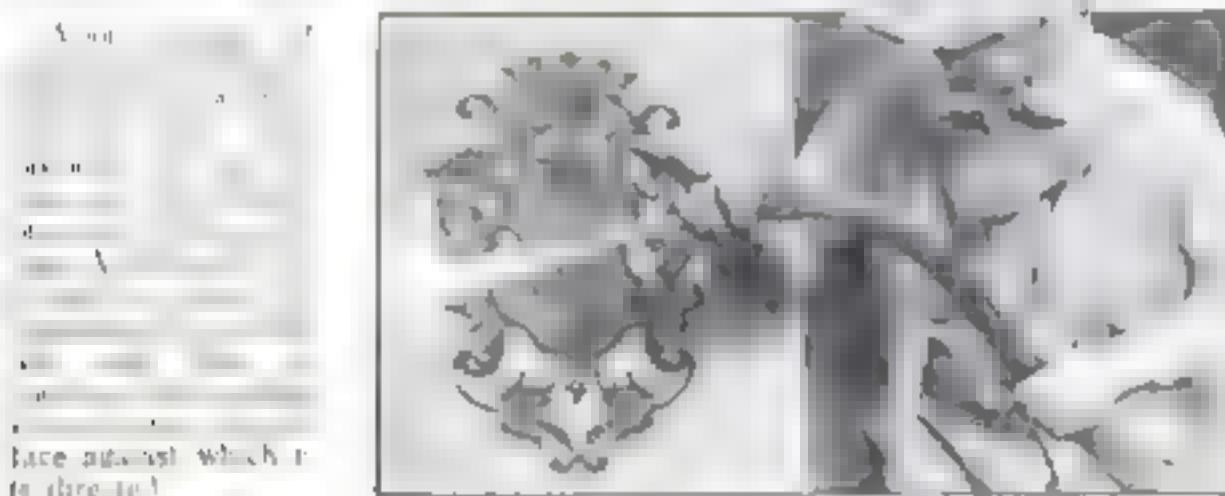
A FEW months ago, Chief Gunner's Mate G. F. Boone, U. S. N., became a man of leisure. In his time over his newly-acquired work he devoted his spare hours to constructing the working model shown at the left which he has placed on exhibition in Washington, D. C. It represents a marine diver in complete working togs supplied with air from a small pump which Boone is pointing to in the picture. Not forgotten are such details as a tiny sheath knife, a telephone head set, and weighted shoes, while valves, hoses, and rubber can are in regulation order.



USE PENDULUM TO TEST HARDNESS OF METAL

Testing the hardness of a metal with a pendulum is the best performer by the

SAND BLAST CARVES WOOD



face against which it is directed.

PLANE'S WHEEL HOOKS TRAILER TO AUTO

SEEKING a coupling for the trailer engagements of a Detroit, Mich.

man in an airplane, complete with its pneumatic tire, was mounted in a flat-



This trailer can be towed at sixty miles an hour when coupled to an auto by means of the airplane wheel used in the manner shown in the circle.

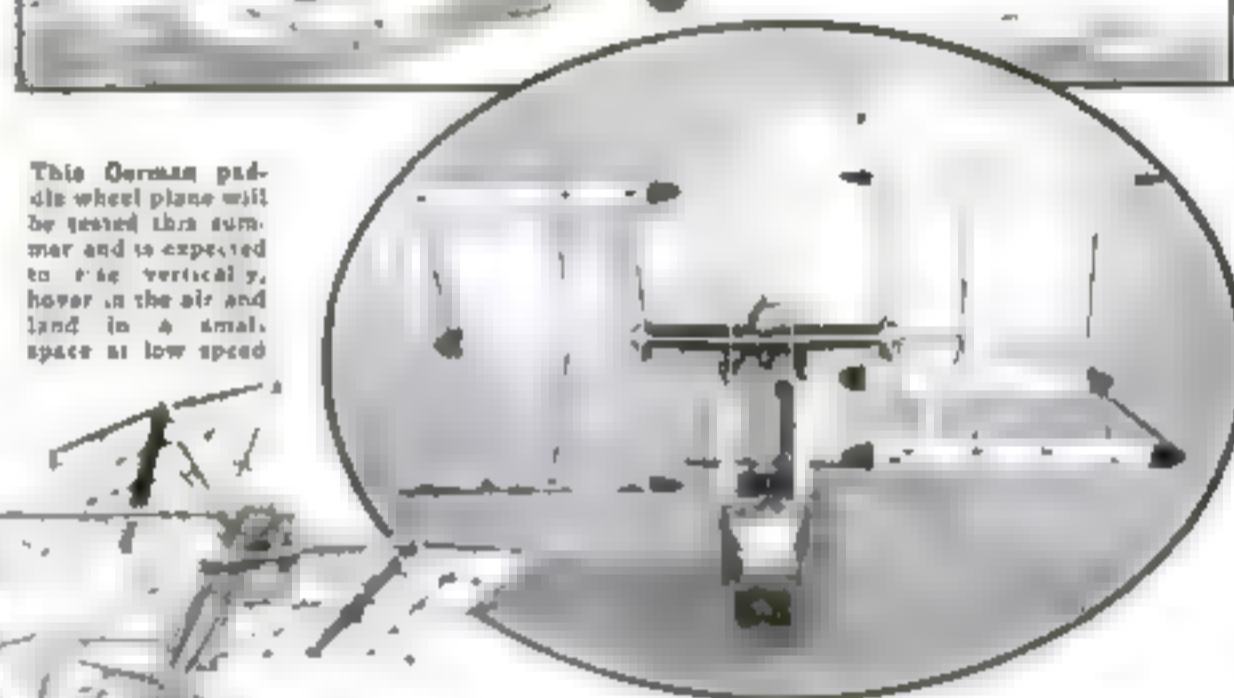
Paddle Wheel Plane for Vertical Flight

Will paddle wheel airplanes be the next great step forward in aviation? No less an authority than Dr Adolf Rohrbach, head of the great German airplane firm that bears his name, is sponsor for the idea of replacing the wings and propeller of the conventional aircraft with immense rotating vanes. Almost simultaneously with the announcement of his plans to build and fly such a craft by this summer, a crop of similar designs by American inventors has been revealed.

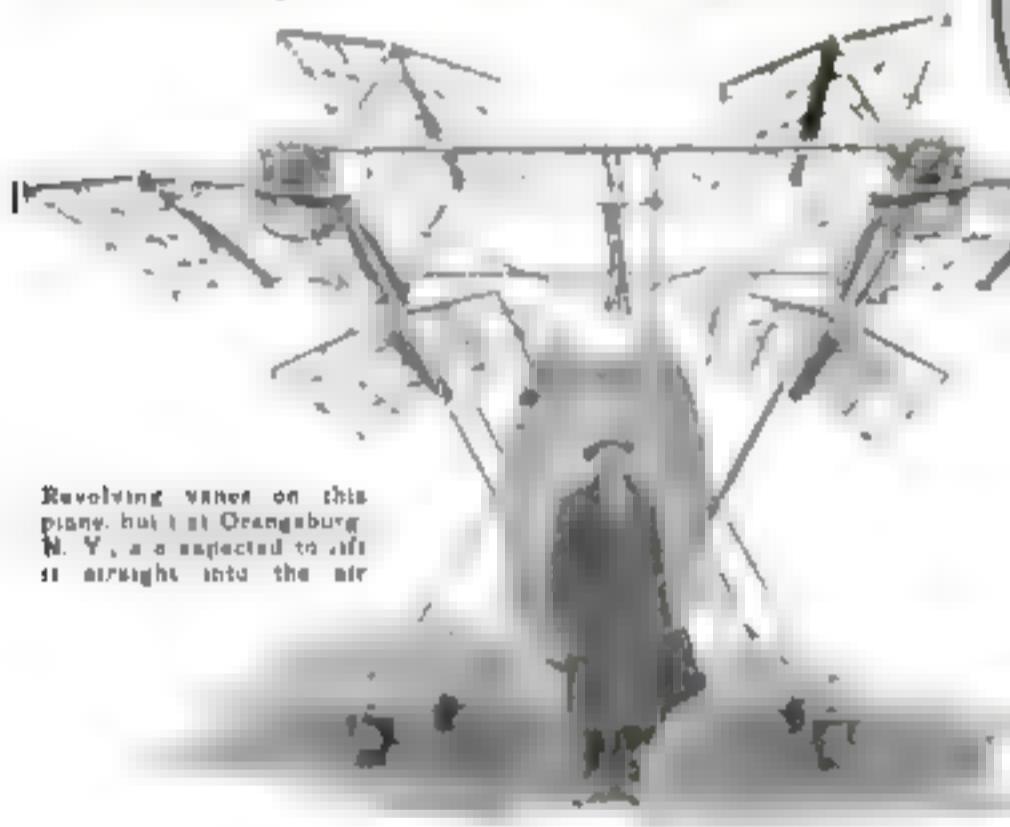
The new Rohrbach plane will be able to rise or descend vertically, move forward or hover motionless in the air, and even—at least in theory—to fly backward. Its fuselage resembles that of a conventional machine, but there the resemblance ends. Lift and propulsion are furnished by slender vanes, arranged in sets of three on a pair of revolving shafts that project from the cabin roof. Their tilt or pitch is automatically controlled so that they slip edgewise through the air in rising and present a broad surface to give traction in descending. Controls to regulate the pitch further have been developed at the Rohrbach factory.



This German paddle wheel plane will be tested this summer and is expected to rise vertically, hover in the air and land in a small space at low speed.



Here is another type of the revolving-vane plane that may change the course of aviation. This Philadelphia machine has successfully met wind-tunnel tests and has interested leading engineers.



Revolving vanes on this plane, built at Orangeburg, N. Y., are expected to lift it straight into the air.

A paddle wheel plane of American invention, similar to the Rohrbach design, was recently described before the Institute of the Aeronautical Sciences in New York. It has been patented by Hayland H. Pratt, Philadelphia engineer, and a model has undergone satisfactory wind-tunnel tests. A full-sized rotating-vane airplane designed by a New York engineer, and propelled by a 240-horsepower motor, was described last month (P.S.M., Mar., '33, p. 24). A variant of the design is embodied in an airplane ready for test at Orangeburg, N. Y., in which the vanes revolve sideways from the metal fuselage.

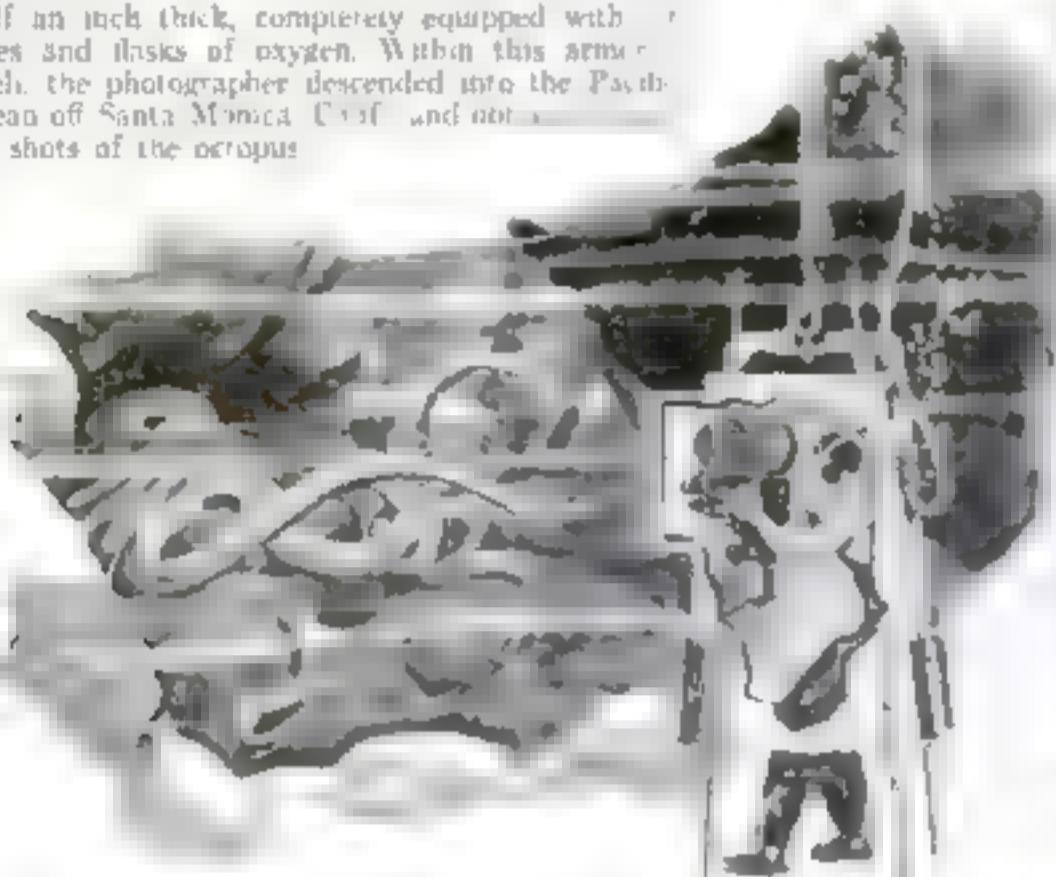
GARAGE USES PLANE TO RUSH HELP TO WRECKED AUTOS

BILLBOARDS near Los Angeles, Calif., announce a new aerial garage service. A phone call brings the repair man by airplane. The quick assistance recently saved a \$3,600 cargo of butter, threatened by 115-degree heat when the truck at right broke down in a Nevada desert.



CAMERAMAN IN DIVING BELL TAKES MOVIE OF OCTOPUS

WHEN a live octopus was added recently to Hollywood's screen stars complications for the cameramen resulted. A scenario called for views of the octopus under water but attempts to get realistic views in a swimming pool were failures. Technicians solved the problem by putting the cameraman inside a steel diving bell which walls half an inch thick, completely equipped with lines and tanks of oxygen. Within this armor shell, the photographer descended into the Pacific ocean off Santa Monica, Calif., and took up shots of the octopus.



HORSE OF STEEL RUNS ACROSS FIELDS



With eyes of steel pipe and powered by a gasoline engine this mechanical horse will gallop along a road or across a rough field.

A MECHANICAL horse that trots along a road or across a field is shown above. It is built of iron and steel.

According to its inventor, a horse, he declares, children may be trained to ride. The iron steed is said to canter along a road or across a rough field with equal ease. Its design recalls the attempts of inventors, before the days of the automobile, to imitate nature and produce a mechanical steed capable of drawing a wagon.

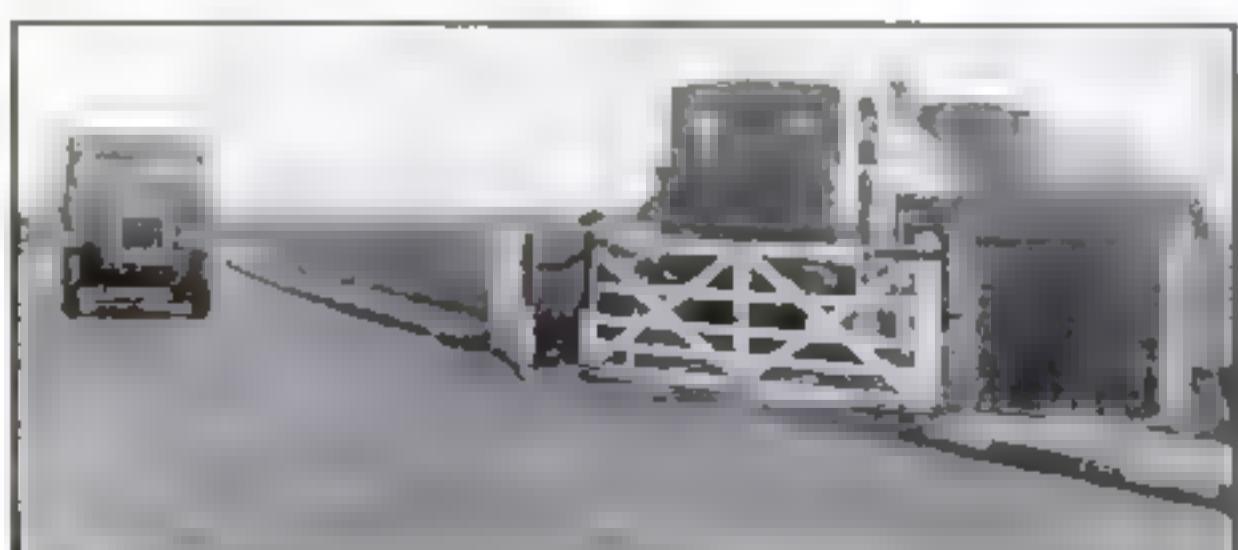


STEEL CANOPY GUARDS STONE AGE BUILDING

GOVERNMENT engineers have just erected the odd steel umbrella pictured above to shelter from the elements a twelfth-century pueblo watch-tower in Arizona. Archeologists consider the mud-walled structure the most important of its kind. The Stone Age builders bored two holes in the walls, so aligned that beams of the rising sun traversed both only on March seventh and October seventh—thus warning of changes in season.

ENTIRE RAILWAY SYSTEM OPERATED BY ONE MAN

UNTRROUBLED by such modern problems as labor disputes and overhead, a queer but little one-man railway in England has successfully resisted the march of modernization. The two-mile line, which connects the towns of Essex and Coryton, possesses one engine, a single passenger coach, and a few freight cars. Its engineer is also the station master, porter, guard and ticket-collector. Twelve times a week the train chugs along the single track, pausing at each level crossing for the opening of gates that bar sauntering pedestrians and livestock from the right-of-way. In this leisurely form of railroading, grade-crossing accidents are unknown.



One man is enginner, conductor, and station master on this English railway. It is two miles long and connects the towns of Essex and Coryton, England, making the trip twelve times a week.

Test Flyers' Oxygen Tank in Air-Tight Vault



LIGHT IN BUILDINGS TESTED WITH TWO ELECTRIC EYES

IS POOR light straining your eyes? To that question, an exact answer is now being given by a compact light meter that shows whether an office, a factory, or a schoolroom is properly illuminated. Twin photoelectric cells are set in a paddle-shaped instrument that is held in the hand and moved over the area being investigated. Even the slightest variations of light show on a dial.



Twin electric eyes, connected to a dials meter, are used to gauge the intensity of the light in any part of a business office or schoolroom. These tests are expected to prevent eye strain.



Coil springs, built into the heel and sole of this shoe, are intended to give it elasticity.

COIL SPRINGS IN SHOE GIVE IT RESILIENCY

BY SOLDERING tiny coil springs into the sole and heel of a shoe, a Missouri shoemaker reports he has combined the springiness of a rubber sole with the wearing quality of leather. Soldered to a metal plate, the cone-shaped steel springs are inserted between layers of the sole during manufacture. They are said to add only slightly to the thickness of the sole. From the outside, the spring-soled shoes resemble other footwear.

AN AIR-TIGHT chamber, reproducing atmospheric conditions 40,000 feet above the earth, is being used by Brush engineers in London to test oxygen apparatus designed for a flight over Mt. Everest, world's highest peak. Bundled up like Arctic explorers and breathing oxygen through rubber tubes, experimenters locked inside the metal vault proved the equipment would keep a pilot comfortable in terribly cold and rarefied air.

In the air-tight chamber at left, a British engineer clothed to withstand severe cold, is using a tube to breathe oxygen from the tank at his left. The test is being made to be sure the equipment provided for the flyers who will attempt to fly over Mt. Everest will work in cold atmosphere.



AUTOMATIC SECRETARY RUNS EMPTY OFFICE

WHEN clients of a new office building in St. Paul, Minn., are called out, they can flip a switch and leave an automatic secretary on duty. A microphone and loudspeaker are installed in each office. When the door is opened, a signal flashes before the girl at the switchboard in the lobby. She says over the loudspeaker: "Mr. X is out. If you wish to leave a message, step to the microphone." The message is taken by the operator.

SECRET SWITCH OPENS LOCK ON CAR'S HOOD

CONTROLLED by a secret switch, a new lock, designed by a Chicago, Ill., inventor prevents an auto thief from lifting the car's hood to circumvent a locked ignition system. Electric latches are attached to the hood and the frame of the car and the wires hooked to the car's battery. The lock snaps shut when the hood is lowered. The switch is used to unlock it.



APPARATUS USED TO TAKE TINY PICTURES

This picture shows how the eye-piece of the microscope is inserted to take a picture. Note that with right and mirror properly adjusted a picture can be taken.



Using a camera and microscope the author made this photo of a frog's stomach.

IN THE world of the microscope, just as in our ordinary world, we can take pictures as we travel. It matters little what kind of a microscope we use so long as it has powers beyond those of ordinary magnifying glasses. Of course, if we are going to push on into the more inaccessible regions of this tiny world we must have an instrument with a power of at least one hundred diameters, that is, a microscope, that will magnify 100 times. This is 200 diameters less than the power of the instrument originally recommended for beginners, but a microscope of this size will open up a series of delightful and wonderful sights.

The type of camera used for making photomicrographs is unimportant, for the simple reason that we do not make use of its lens. On the contrary, we remove the lens. The microscope itself forms the lens system and the picture we see when we bring our eye to the ocular is projected on the film of the camera. In effect, the microscope acts like a little magic lantern; instead of projecting pictures upon the wall, we project them upon a sensitive photographic film.

Although almost any type of camera except the very smallest may be used, a plate camera that takes 4 x 5 or 5 x 7 pictures is best suited for use with a mi-

How TO TAKE PICTURES *with your Microscope*

Such cameras not only give good views but permit us to bring the eye to sharp focus on the ground glass plate before the film is exposed. With a little ingenuity the owner of a smaller camera can get good microscopic pictures.

In this work fine and careful focusing is essential for we are dealing with focal lengths so short that hairsbreadth distances count. A focusing screen is absolutely necessary but the owner of a small film camera can remove the back of the instrument and fit it with a ground glass for focusing. If ground glass is not available, a piece of ordinary tracing cloth of the kind used by draughtsmen can be used. Since it is necessary to remove and replace the film in this process, the work must be done in a dark room. Each time the film in the back of the camera is brought forth, the illumination will have to be cut off from the microscope.

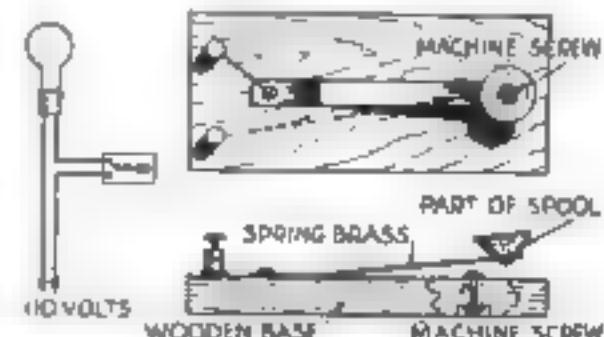
WE REMOVE the lens from the camera and pull the tube of the microscope back to a horizontal position so the eyepiece of the microscope butts right up to the hole in the camera bellows formerly occupied by the lens. Around this crude joint we wrap some soft black cloth free from dust.

The light for the microscope is arranged from above. Throwing a black cloth over our head, we peep into the ground glass at the same time manipulating the microscope mirror under the stage until the ground glass is illuminated with an even light.

Next a slide is inserted and we continue with our adjustments, focusing the micro-

scope and manipulating the bellows of the camera until our picture is of the proper size and the proper sharpness. To do this we may find it necessary to raise the camera upon books until the proper height has been reached.

WHEN the focusing has been completed, the light source is turned off and the plate or cut film is inserted. Now we come to the matter of exposure which brings us face to face with the choice of film. The newer films, with high color sensitivity, are best for microscopic work. If cut film is used, panchromatic film will be found both fast and faithful; but here photographic skill is required, to a greater extent anyway than if the slower emulsions are used. If ordinary film is used, several seconds' exposure may be given with a low-power electric light, say forty watts. But how are we to control this matter of exposure when we have to manipulate a crude switch on a lamp socket in place of a precise camera shutter? The writer has found that a small electric key connected in series with the electric light



Drawings show how to rig a key to a lamp socket, so accurate exposure time can be secured.



MIRROR

SPRING
BRASS CLIP TO
FIT MICROSCOPE

DRAW YOUR OWN PICTURES

Micro drawings like the one of the antelope upper left can be made by any one as illustrated above if the mirror and brass clip device shown at left is attached to microscope

solves the problem. The details of this little key are given in the drawing.

The outfit that we have been describing is rather crude. Those who wish to pursue microscopy in a serious way undoubtedly will wish to construct more elaborate equipment. In the drawing on this page are details of a bolder that will accommodate both a microscope and a camera. This is made of soft pine. The board upon which the camera is mounted is provided with a slot so the camera may be moved up or down. This not only permits more rapid adjustment but insures against movement of the camera when the plate or film is inserted and also provides a convenient focusing position.

IN WORKING with this equipment, a little practice will be needed before you can adjust the size of the image correctly upon the plate. If the image on the ground glass screen is not large enough or does not completely fill the plate, simply move the bellows of the camera out and re-focus until the size is correct. Determining the proper exposure also may be a little difficult at first so it is best to make a test by exposing and developing a few films or plates. Exposure depends upon two factors—the nature of the object and the power of the illumination. A fly's wing, for instance, is transparent and does not need as long an exposure as do specimens that pass less light.

As we gain in skill, we find that we can photograph opaque objects as well as transparent ones. If, for example, we wish to photograph a surface, we arrange our illumination above the stage of the microscope so that part of it strikes the surface and is reflected off and up through the lenses of the microscope system.

Photography of surfaces is of vast importance to industry. Much of our progress in the compounding of new alloys in the past few years has resulted from the study of metallic structure made possible by means of the microscopic examination of surfaces. Each metal alloy tells its own



With the light arranged so that it fell from above, this picture of a mosquito head was made. Note strength of the fine delicate

story under the lens, and although the microscopist in this field cannot peer down into the body of his specimens, by treating these specimens with certain acids and alkalies and by polishing, he can gain a complete knowledge of their structure and the effects upon this structure of the addition of various materials. Metallurgy owes a great debt to the microscope. Modern steels and the industrial progress that has come from them would have been impossible without the careful work of the metallurgist using a microscope.

ALTHOUGH the amateur worker cannot gain access to the field of moving photomicrography, he will be interested to know that bacteriology and medicine have received tremendous help from this source. It is one thing to see bacteria dead in pictures and quite another thing to make moving pictures of them for study. The habits of a number of deadly organisms have been discovered by this use of the microscope and camera.

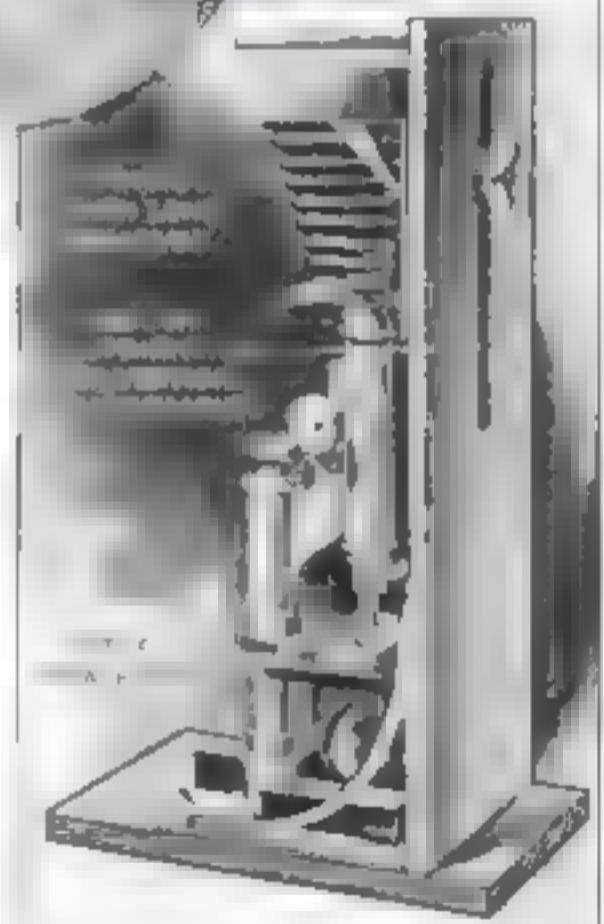
That the amateur who does not have a camera may still make picture records of his microscopic studies, the writer has

Pictorial Records of Things the Unaided Human Eye Can Never See Are Easily Made With the Apparatus Described Here

By BORDEN HALL



The porous nature of a corn stem is clearly seen here. At 40x, section of grass blade



This diagram gives the details of a camera and microscope stand with which fine adjustments are possible so that unusual pictures can be taken

included a picture showing how drawings of microscopic objects may be made and colored with water colors, by persons of no training in art. By this method tiny sketches may be made as notes, or with a little more trouble, accurate detailed drawings may be prepared. To do this a small mirror of good quality is cut about one inch square. This is held in a small brass clamp and placed on the end of the microscope at *(Continued on page 98)*

German Truck Is Easily Changed Into a Farm Tractor



After a day's work, the tractor tread hooks to the truck and a windlass hoists the plow up the runway

TRUCK and tractor in one is an unusual vehicle designed by a German inventor. When it has been driven to the edge of a field, the rear end is jacked up and a demountable endless tread is substituted for the rear wheels. The converted tractor is now ready to pull a plow through the field. After the day's work is done the rear wheels are replaced, the tractor tread is hooked on behind as a trailer, the plow is hoisted board by a windlass at the rear of the truck, and the farmer is ready to drive home.

GUARD OIL FIELD WITH CIGARETTE LIGHTER



AN ELECTRIC cigarette lighter, shielded from the weather by a small roof, is an odd sight at a corner of a Beaumont, Texas, oil field. So dreaded a hazard is fire here that workmen are forbidden to carry matches. Violation of this rule is considered almost as serious an offense as it would be in a powder plant. To encourage its observance, the owners of the field installed the lighter, just outside the danger zone, for the convenience of employees who wished to smoke during the noon hour. As a result, the field boasts an enviable safety record.

OCEAN ISLAND FLOATS

A DERELECT island of floating vegetation is reported by the U. S. Hydrographic office at San Diego, Calif. The wandering isle, sighted 1,300 miles from San Diego in the Pacific, is said to be half an acre in extent and to have trees twenty feet high growing on it.



With tractor tread substituted for the rear wheels, the combination tractor and truck will pull a plow

MODELS FIX BLAME FOR SEA WRECKS

DIMINUTIVE models of river steamships and ocean liners now aid German courts in fixing responsibility for marine accidents and in passing on claims for insurance. At the start of a trial held in a special men's court, a large-scale map of the waters involved is spread out. Witnesses then use the models to illustrate the positions of their vessels at the time of the accident. After all have testified, a decision is rendered by a judge well versed in navigation and by four assessors.



This picture, taken during a trial, shows boat trial experts using models to fix the blame for a collision on the River Elbe



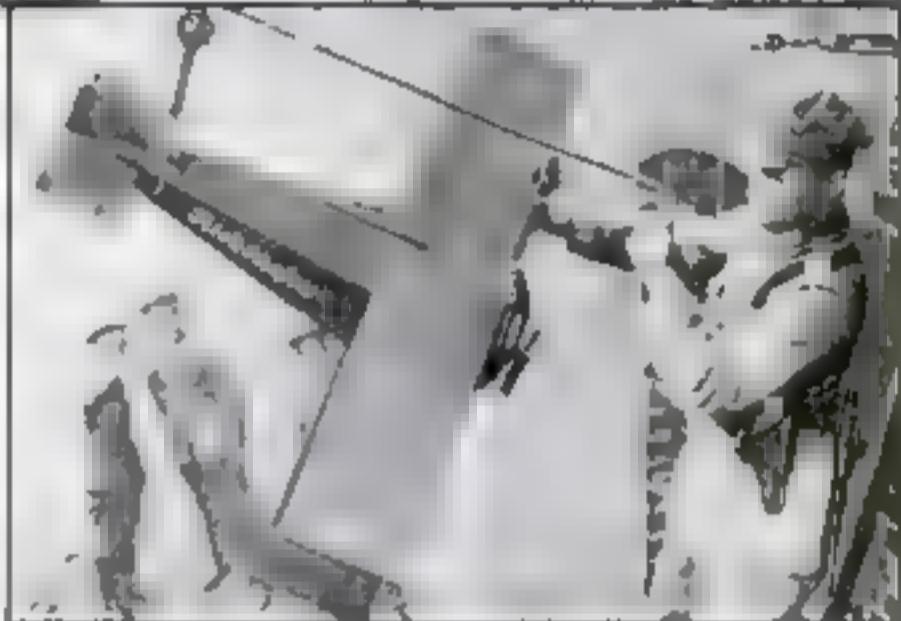
USE NEW PERISCOPE TO PROTECT BANK VAULT

TO MAKE IT IMPOSSIBLE for thieves to plunder a bank vault while a watchman is making his rounds, a German optical firm has devised a new form of periscope to be inserted in the wall. Through its eyepiece, as shown at left, the watchman may scan all four walls, the floor and ceiling as thoroughly as if he were looking in a window. As an additional precaution, the periscope, when not in use, is protected with a heavy cover that locks on so it cannot be tampered with.



A Ground Model for Flying

Flyers Get Gun Practice with Model Planes on Ground



ROBOTS STAGE REALISTIC PRIZE FIGHT

Mechanical men stage an exciting boxing contest in a new game invented for amusement resorts. Two contestants play the game each controlling one of the boxers with a hand wheel. Animated by a system of electro-magnets the figures

swing their gloves up, down, or sideways and duck with surprising realism. If one of the dummies is struck by an upward-swing glove at a certain critical point on the chin it falls to the floor as shown in the photo below, and a knockout is scored.

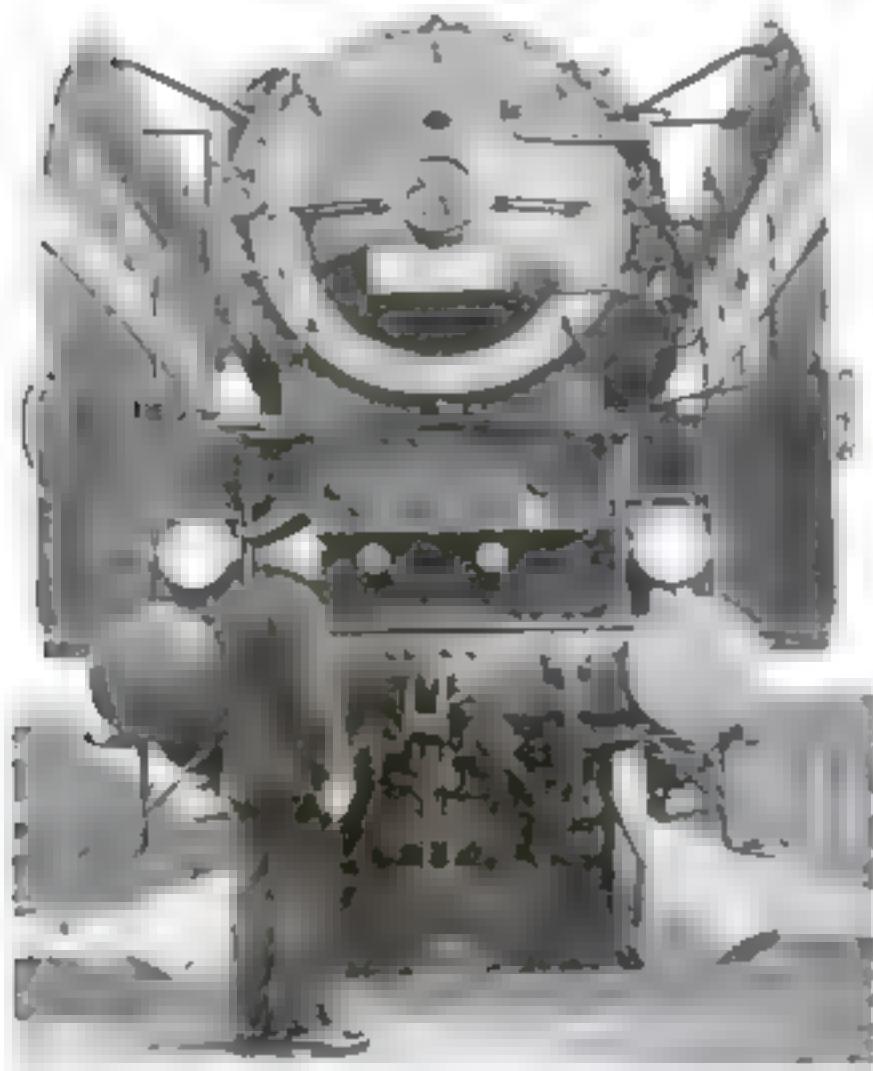


NEW MOTOR FOR FARM IS ROLLED TO WORK

An ELECTRIC motor that rolls to its work is the product of a German electrical firm. One man can move the heavy machine as shown above. Heavy rims protect the motor from damage. It is intended for use on farms where portable power plant is necessary.



LOCOMOTIVE CAN HIT 145 MILE SPEED



Captured by the photographer at so unusual an angle that it has the appearance of an eagle poised for flight, a new German locomotive is designed for a normal speed of two miles a minute. Its builders however declare it is capable of attaining 145 miles an hour with wide-open throttle. The big engine was built in the famous Krupp works and is said to employ steam at unusually high pressure. Its odd design was scientifically worked out to minimize wind resistance and to deflect smoke from the engineer's field of vision, since at such speeds a clear view of the track is vital to safety.

New German locomotive, left, is streamlined to reduce air resistance and deflect the smoke from the engineer's field of vision.



AUTOMATIC DIAL CALLS FLYING PILOT ON PHONE

Radio dispatchers along the transcontinental airway of the United Air Lines now speak at will to the pilot of any particular airplane in flight, by dialing his number as shown above. The device used resembles a conventional dial telephone but automatically selects the radio wavelength to which the desired craft's receiver is tuned. It also adjusts the volume of the radiophone tone. One of these ground stations makes contact with each plane in its territory every twenty minutes.

USE RUBBER FUNNEL TO PUT WATER IN BATTERY

Filling the cells of a storage battery with distilled water is simplified by an attachment for standard glass fruit jars designed by a Placerville, Calif., woman inventor. The device is a funnel-shaped rubber cap with a short tube at the end. The cap is screwed on the jar and carries the water into the battery without spilling it when the jar is inverted. The flow may be shut off by so doing pinching the tube while the cell is full.

Designed to fit a 1-gal. fruit jar, the funnel-shaped rubber cap prevents spilling the water when filling a storage battery.



Exhibiting timer that automatically opens chute

CARGO 'CHUTE LANDS EGGS UNBROKEN

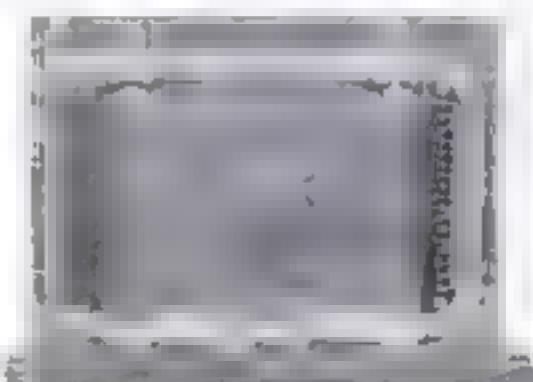
Eighty-six pounds of food supplies were dropped from an airplane to a party of girl campers at Big Bear Lake, Calif., the other day in a demonstration of a new cargo parachute. A dozen eggs within the pack were unbroken when recovered.

The 'chute, devised by a Los Angeles, Calif., inventor is provided with an electric timer that automatically opens it at a predetermined height above the earth. This minimizes jolting and would enable food to be dropped to castaways.



MERCURY IN TUBE GAGES TRAIN'S GAIN IN SPEED

How fast a train can pick up speed is measured by an "accelerometer" devised by a General Electric engineer. Its glass tube, mounted on a flat base and set on a window sill, contains mercury. When the train is standing still, the mercury stands at zero but surges backward as the train gains speed. This change in level permits the acceleration to be read from a scale.

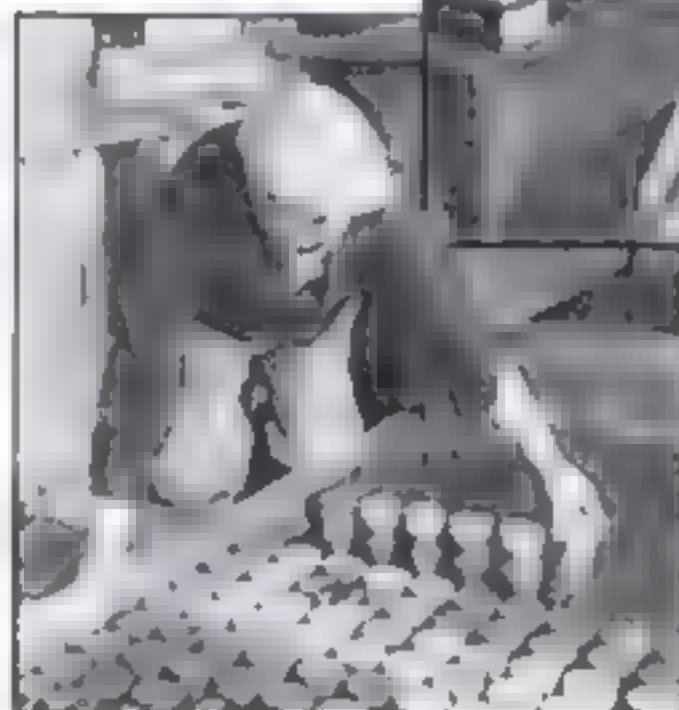


New Instruments Help Architects



trous or other questions to government research laboratory to determine where architect can best profitably To find which before the house is built, a new using a solar calibrator, a model of a wall setup.

SOLAR CALIBRATOR
In sun is represented the lamp, which is raised or lowered in a vertical arc marked with months of the year. When model is rotated above a dial indicating the time of day, beams from the lamp show the amount of sunlight entering the window at any point. In other tests, modern types of instruments are being developed to help



tive durability. Even specialized problems such as that of making concrete particularly resistant to sea water are studied at this strange research laboratory.



SCHOOL USES MACHINE TO MARK ALL EXAMINATION PAPERS

Students in a school in Michigan have their examinations marked and graded by robot scorers. In a test student is handed a list of questions with a choice of several possible answers, together with a supplementary card bearing numbers corresponding to the answers. He uses a punch to mark upon the numbered card the answer that he believes is correct. When the test is completed, the perforated cards are fed into the robot machine. A light flashes opposite each question correctly answered, and a meter dial indicates the total grade credited to the student.



RUBBER SLAPPER OUSTS THE POLICEMAN'S CLUB

Rubber slappers have taken the place of wooden clubs familiarly known as billy clubs in the hands of Indianapolis police. Invented by Chief of Police Michael Morrissey, of that city, the new weapon is a flat, heavy block of rubber with a slot for the fingers. It is declared more humane and fully as effective as a club, for it can deliver a stunning blow without drawing blood or cracking a rioter's skull. In the photograph above, an officer compares the slapper with the stick formerly carried

Steel Shield for Policemen is Bullet-Proof



THREE FACES ON ONE PORTRAIT



METALS THAT VAPORIZE
SECURED IN NEW WAY

TEST OF RATE METAL WIRE

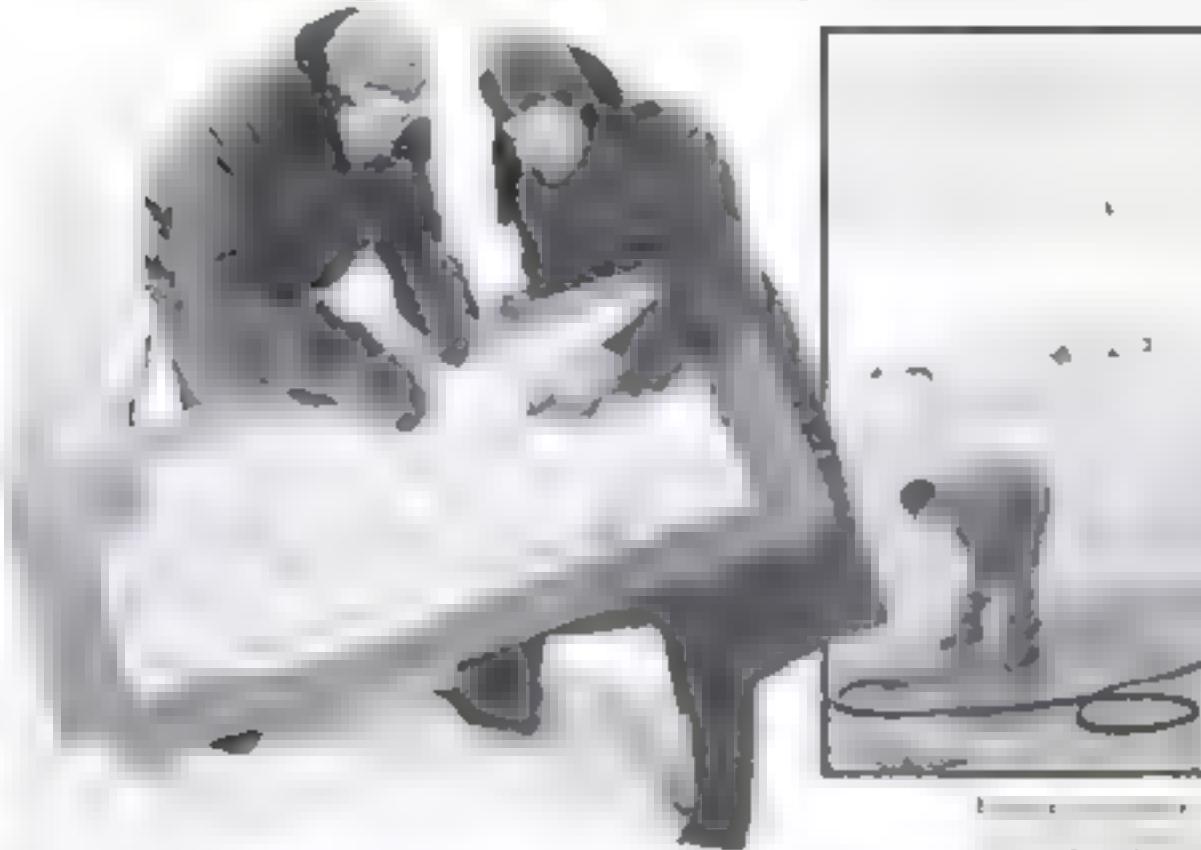
Metals	Rate
Aluminum	1000 ft. per sec.
Boron	1000 ft. per sec.
Copper	1000 ft. per sec.
Iron	1000 ft. per sec.
Magnesium	1000 ft. per sec.
Phosphorus	1000 ft. per sec.
Silicon	1000 ft. per sec.
Titanium	1000 ft. per sec.
Zinc	1000 ft. per sec.



TEST OF RATE METAL WIRE

Metals	Rate
Aluminum	1000 ft. per sec.
Boron	1000 ft. per sec.
Copper	1000 ft. per sec.
Iron	1000 ft. per sec.
Magnesium	1000 ft. per sec.
Phosphorus	1000 ft. per sec.
Silicon	1000 ft. per sec.
Titanium	1000 ft. per sec.
Zinc	1000 ft. per sec.

Air Maps for Army Made on Short Notice



Left: Two Army Air Corps students inspect a completed air map made in the field. At right: A student works on a map.



Mobile darkrooms follow the U. S. Army planes so that air maps can be rapidly developed. The picture shows students placing one of their bins drying seeds in position for use.

MODELS AID CRYSTAL STUDY

Dr. Francis Bitter, Westinghouse engineer, with the egg-shaped model he has designed to show properties of iron crystals in a magnetic field.

White objects resembling the eggs of some fabulous creature, shown in the accompanying photograph, help to make clear to engineers a complex but useful phenomena of physics. The models were constructed by Dr. Francis Bitter, Westinghouse engineer, to illustrate the properties of a crystal of iron in a magnetic field.

Extremely delicate measurements show that crystals, like other bodies, tend to be attracted or repelled to some extent by a magnetic pole. The models express graphically the relative force of the magnetic effect in different directions.



A PUTTY knife with an offset blade has been introduced. The offset edge drawn toward the user, becomes a hook for the removal of old putty as shown in the lower photograph. When the tool is drawn sideward as a scraper on a leg or metal container (upper photo), the offset design guards the worker's knuckles. The versatile tool is also recommended for removing paint and wallpaper—all of this is in addition to its use as a putty knife.

Experiments with Colloids



By Raymond B. Wailes

WITH a beam of light and a test tube, the amateur can study the chemistry of sunsets, fogs, and river deltas.

Like crystals of sand and sugar, most substances fall into two classifications—those that form true solutions with a solvent and those that unquestionably do not. Sugar particles stirred into water soon disappear. Sand, on the other hand, remains always visible and soon settles to the bottom.

Unlike either of these, however, is a third and far more interesting group that neither disappear like sugar nor separate out like sand but remain suspended in the liquid. They literally hang in the solvent as ultra-microscopic particles larger than the tiny bits in true solutions, yet smaller than the larger masses that separate out. To these, the chemist has given the name "colloid."

Every time you wash your hands with soap you are making use of a colloidal property. Paint is nothing more than colloidal particles of pigment suspended in a drying oil and automobile tires consist largely of colloidal lampblack and other fillers suspended in vulcanized rubber.

Milk is a colloidal suspension of albumin and casein, and coffee is made up of colloidalily suspended particles. Unfortunately the color of milk and coffee prevent their use in the tests that can be made in the home laboratory. However, the amateur experimenter can make a simple colloid by adding water to some rubbing alcohol or after-shaving lotion. A white precipitate will be formed which will not settle out.

A bit of rosin placed in alcohol diluted with water also produces a colloidal solution. Small particles suspended in the liquid give it a coquettish opaque appearance. Unlike a precipitate, however, repeated stirring will fail to remove the tiny particles.

To be reckoned, a colloidal mixture often resembles a true solution. In most cases, the tiny suspended particles can not be seen under normal conditions. However if a test tube containing such a colloid is placed in the path of a beam of light, each small particle will reflect such light brightly. A bright cone of light will be formed in the liquid.

This action of a light beam on a colloidal suspension is called the Tyndall effect and the apparatus for observing it consists of a strong light source such as an electric light bulb, and a large piece of cardboard having a small hole pierced near its center. When using the light beam, hold the cardboard shield a few inches from the lamp and place the test tube close to the surface of the card.

The same visible beam of light is formed when bright sun streaks through a small opening into a relatively dark room. The tiny invisible particles of dust in the air become instantly visible, each microscopic speck becoming a spark of light. In this case, the dust is a colloidal suspension in the air.

In the same way, the red of sunsets is due to the light reflected by the colloidal dust in the atmosphere. Also fogs become visible because of the tiny reflections of light from the droplets of water suspended in the air.

The fine clay carried down by rivers is merely suspended in the water. When the river strikes the ocean, these particles of clay are thrown out of their colloidal condition and are precipitated out. As the precipitate accumulates, a delta is formed at the river's mouth.

1
m
h
e
d
t
the

droplets of liquid on one side
will form an membrane

for the HOME CHEMIST

Gold Solutions and Novel Gels Are Easily Made in Your Laboratory with the Apparatus Described Here

Many substances can be made to appear in colloidal state. A solution of potassium permanganate, for instance, will produce a colloidal form of manganese dioxide if some household hydrogen peroxide is added to it. Several drops of iron (ferri) chloride solution in boiling water will produce a rich, red colloidal suspension of iron hydroxide.

Colloidal gold can be made in the home chemist's laboratory in several ways. A strip of aluminum placed in a solution of gold chloride will cause the gold to be deposited out in a colloidal condition. The resulting solution will be a purple red when the beam of light is viewed through it and yellow when viewed from the side. The gold chloride for this experiment can be obtained from most drug and photographic supply stores.

Gold in a colloidal form also can be obtained by forming an electric arc between two gold terminals or electrodes held under water. Pieces of discarded gold jewelry will come in handy for this experiment.

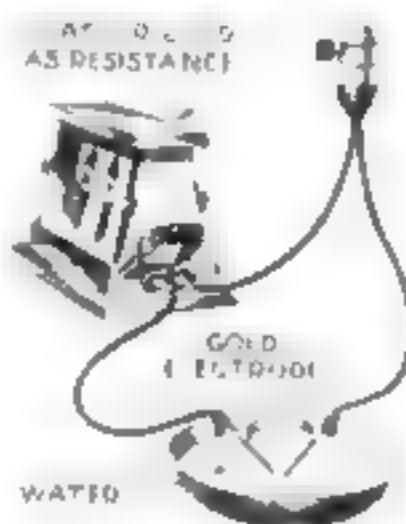
CONNECT two pieces of gold in series with some electric appliance, (such as a toaster or heater having a rating of 500 or 600 watts) and the two terminals of an electric socket. Then, after taping the connections to the gold strips to form insulated handles, touch the tips of the two gold terminals under the water. When the circuit has been closed long enough to heat up the device wired in series slowly move the terminals apart to form an arc.

This arcing will cause the gold to be distributed through the water in a colloidal state and the familiar blue color of colloidal gold will tint the water. Other metals, such as silver, can be thrown into colloidal suspension in the same way. Incidentally, colloids of metals are very stable and often do not separate out for years.

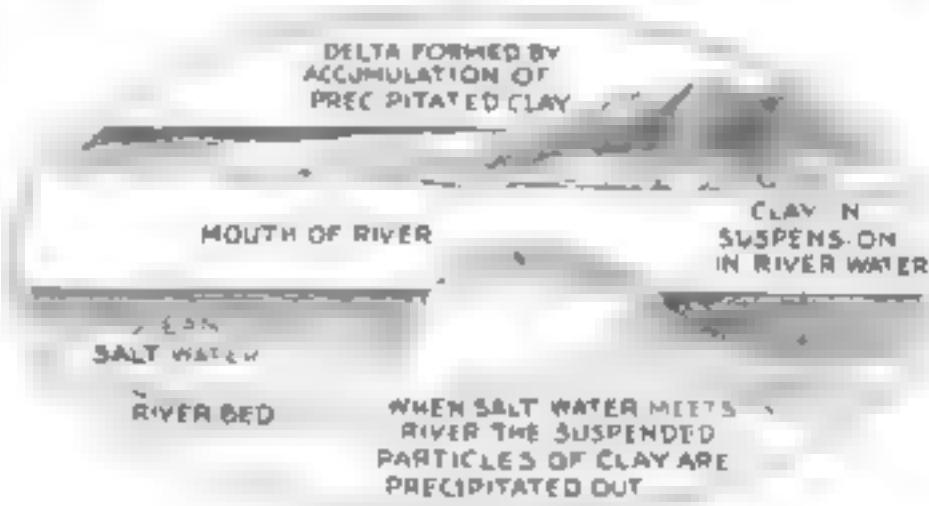
The amateur chemist also can grind substances until they are so fine they can be suspended colloidal. The graphite from a lead pencil, for example, can be ground so finely with a mortar and pestle that it will become colloidal graphite.

When small particles of liquids are evenly dispersed through solids they are called colloidal gels. Most common of all gels is the gelatin type of dessert that becomes a jelly-like mass when it is placed in the refrigerator. A comparatively small quantity of gelatin gives a large quantity of water a semi-solid appearance.

In setting, the colloidal particles of gelatin unite with water and then join



With the apparatus arranged as shown in the drawing, gold and other metals can be obtained in a colloidal form. Above, a metal is being sparked beneath water to decompose it as a catalyst.



with each other to form a microscopic sponge-like structure throughout the mixture. Large quantities of water are held in the tiny cellular spaces.

A novel gel can be made from water glass (sodium silicate). Add an equal part of water to some water glass and to this add an equal amount of muriatic (hydrochloric) or sulphuric acid. Shake the resulting mixture and allow the gel to set. This particular gel is called the silicic acid gel.

In this experiment, you may find that the gel will set before the mixture can be shaken. If this is the case, dilute the acid and use less of it.

If the gel is allowed to set in a U-tube, beautiful precipitation experiments can be performed. After the gel has set, pour some lead acetate solution on top of the gel in one branch of the tube and a solution of potassium iodide on top of the gel in the other. In a few days you will

notice the formation of artistic sponges of lead iodide in the jelly-like mass.

If potassium dichromate and silver nitrate solutions are used in place of the solutions of lead acetate and potassium iodide, beautiful bands of color will appear in layers.

MAKE a similar gel from some water glass to which lead acetate has been added, place it in a test tube, and set it by the addition of muriatic (hydrochloric) acid. The familiar Lead Tree or Tree of Saturn (P.S.M., July, '32, p. 61) will be formed when a thin strip of zinc is pushed into the mass.

An interesting experiment with ordinary unflavored dessert gelatin can be demonstrated by making up a gelatin solution according to the directions on the package. While the gelatin is still hot pour it into a test tube and add a small crystal of potassium dichromate. (*Continued on page 109*)



SELF OPENING TABLE
Pressing a button, set in
the side of this bridge
table, automatically opens
all four of the legs at once



PORTABLE POTATO BAKER This kitchen invention, right, is a portable electric baker in which supplies of potatoes enough for two can be baked. It attaches to any light socket.

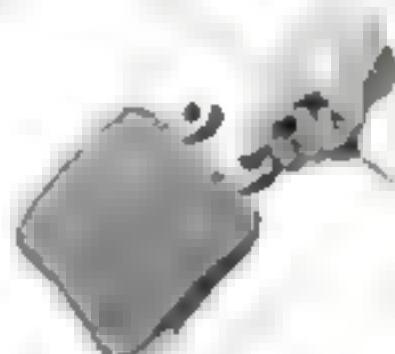


ALL-METAL LAUNDRY CHUTE A door in wall or floor of the bathroom opens to this laundry chute down which soiled clothes slide in a container in the basement. Photo at right shows arrangement of chute in the basement where clothes are removed

HOME Conveniences THAT SAVE TIME

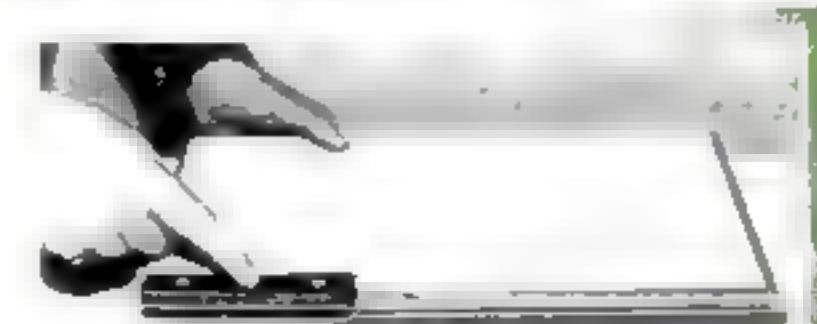


SHIELD FOR PARING KNIFE This simple attachment fits any paring knife so potatoes are peeled quickly with no waste



PILLOW FOR BATHTUB Made of soft rubber, the bathtub pillow shown above is secured to tub by means of vacuum cups and makes a convenient rest for the head

CLEANING FLUID IN HANDLE This upholstery brush left has a hollow handle in which cleaning fluid can be placed and released for use by pressing a valve with the thumb. It is of non-corrosive metal and can be used in car or home



BREAD KNIFE ALWAYS HANDY Into a groove at the side of this breadboard, the knife fits snugly so it cannot be misplaced



NEW STYLE IN KITCHEN CABINET Design of the modern kitchen cabinet shown above has a sunburst shape in place of the usual flat back and includes a fourth

SHINE YOUR SHOES Two views below show a new automatic shoe shiner. It uses Aspalite of the shoe sole cleaned and polished by the changeable polishing ribbon.



BROILING IN PAN This double pan is made of aluminum and is designed for use as a broiler. It is said to eliminate the disadvantages of charring and burning grease.



LAMP RUNS RADIO The hours of the day are dialed on the shade of this lamp. When the point of is set at any desired hour and the lamp sits bed to the radio it will turn on the set.



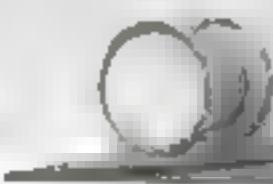
RUBBISH PAD FOR MOP The soft-wearing mop shown at hand below is equipped with a rubber pad that is easily attached or removed and can be used to remove spots and stains.



WATERPROOF HEATING PAD Since this electric heating pad is waterproof it can be washed with soap and water to assure cleanliness. It is made of wire, metal thermostat, and heat-resistant rubber. Notches in switch never enable you to adjust it in the dark to any temperature you may desire.

NOZZLE STOP SPLATTERING Attached to the faucet in a kitchen sink this nozzle, which has a mesh wire screen, keeps the water from splattering. When the central hole is closed the water comes as a spray for rinsing dishes.

When Natural Laws Look Wrong



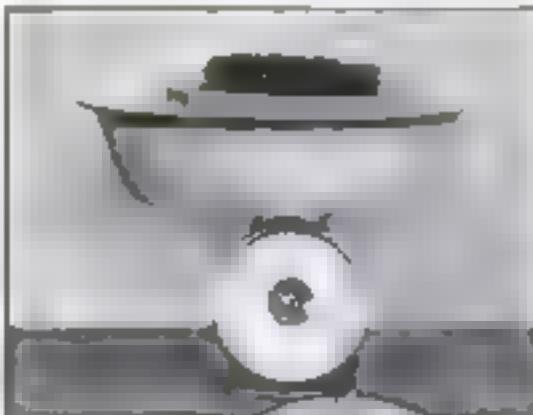
This spool pulled up the incline by a string rolls forward, winding up the string.



Pulling the string tied to spoke of wheel rolls wagon forward if there is no slipping.

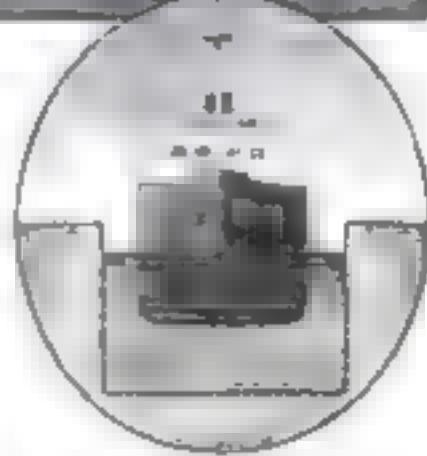
LEVER ACTION MAY MOVE OBJECTS IN MOST UNEXPECTED DIRECTION

You can't always trust your eye. What you think you see may be wholly different from the facts. The truth of this statement is proven by the strange experiments illustrated on this page. For instance, does it not surprise you that pulling the string in the upper picture will make the spool roll *uphill* and wind up the cord? Or that the wagon wheel in the lower view, is revolved toward the person who pulls a string attached to a lower spoke? Here the action is that of a lever as long as there is no slip the ground becoming the fulcrum. Note the spool's rim is very large



BIG SHIP ADDS NO WEIGHT TO BOTTOM OF CANAL LOCK

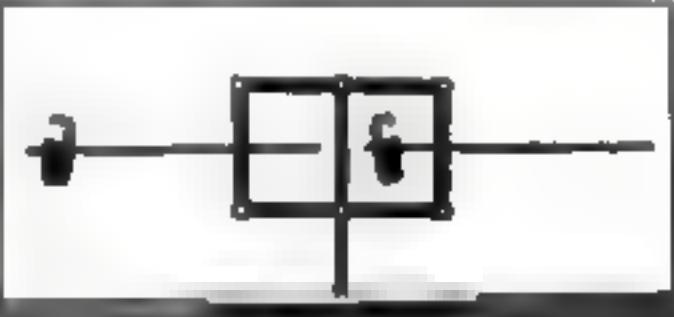
IS THERE more weight on the bottom of a canal lock, when a big ship floats in it, than when it is full of water? No, if the water is unchanged, for the ship displaces a quantity of water exactly equal in weight to itself. To prove this, fill a pan containing water and set it on a scale (upper left). Then a weighted vessel in the water (upper right). The total weight remains the same, as the scale shows, regardless of the second vessel's contents. Just water enough to offset the added weight is spilled over the edge of the pan.



A big ship floating in a canal lock does not increase the pressure on the bottom of the lock. Experiment with pan of water at the top shows why this is true.

BREATHING IN WATER

Did you ever hear of persons walking under water, and breathing through tubes, as shown at right? It looks easy but it can't be done! At a depth of only one foot, water pressure is distinctly felt. A few feet deeper, it presses so heavily upon chest and abdomen that the breathing muscles cannot expand the lungs so air can enter. You can breathe out but you can not breathe in. The man in the picture will find it impossible to breathe. In a diving suit air pressure balances water pressure.



EQUAL WEIGHTS AT UNEQUAL DISTANCES WILL BALANCE

LOOKING at the figure above, you would at once say that the two weights, although distant from the center, keep it out of balance. That's another case where your eyes fool you. Six joints, marked with white dots, are loosely pivoted; the other joints are solid. As a result the left weight is balanced by the right one. If you look closely you will see that the downward pull of each weight is applied only at one of the two rigid points.

HORSES TUG AT HEMISPHERES HELD TIGHT BY AIR'S WEIGHT

BY THE experiment pictured below, Otto von Guericke, seventeenth-century scientist, demonstrated at Magdeburg, Germany, the amazing force of air pressure. He fitted together a pair of twenty-two-inch hemispheres of copper and pumped out the air between them. Then it took sixteen horses to pull them apart. Eight horses could have done the job if they had all been hitched to one hemisphere while the other was anchored to a tree.



Two hemispheres, from which the air has been pumped, are held together so tightly by air pressure that many horses are needed to pull them apart.



The simple electric organ shown at top was used in a coast-to-coast broadcast. Below it playing this unusual instrument only one key at a time is pressed.

How to Build an Electric Organ

FOR ABOUT FIVE DOLLARS

WITH its deep, mellow notes, the electric organ is fast gaining the musical limelight.

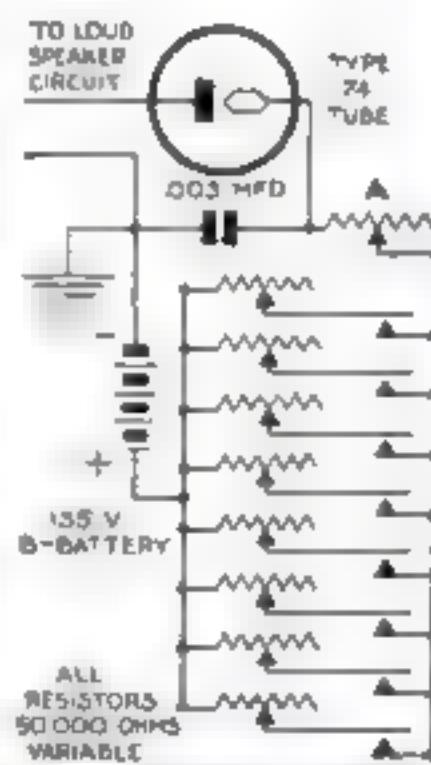
As a rule these instruments are large and costly. Yet for the price of a new hat, you can build a duplicate of a small organ that was featured in a recent coast-to-coast radio broadcast.

Complete, the original instrument cost its designer, Emore B. Lyford, a New York electrical engineer, a little more than five dollars. In spite of its low cost, its rich organ-like notes delighted the well-known radio aunts that fingered its keys and its simplicity interested the engineers that examined it.

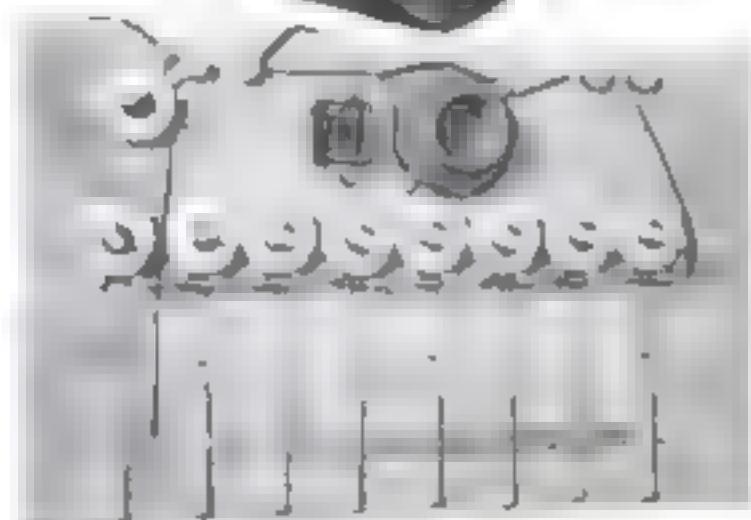
All you need to build the organ is nine 50,000-ohm variable resistances, a .003 microfarad condenser, some brass, a type 74 voltage regulator tube, a socket, and a few feet of insulated connecting wire. For power, the organ uses three forty-five-volt B-batteries.

Although the organ can be connected directly to a loudspeaker, best results are obtained if an audio amplifier is used with the speaker. Of course, if you have a modern radio, you can use its amplifier and speaker by making connections to the detector tube or through the phonograph jack attachment. In the photograph, a separate amplifying unit and speaker are shown.

The keys can be bent from strips of brass or ordinary push buttons can be used for the contacts. In fact, if you are really ingenious, the keyboard of an old toy piano can be rigged as your electric console. Al-



A plan view of the organ keyboard is given above showing the nine variable resistances in place. At left diagram to aid in building the electric organ. Below tuning the organ by adjusting resistors.



though only eight keys, corresponding to the scale, were used in the original, more can be added to obtain the intermediate tones.

With the tube in place and the organ connected to the speaker circuit, you are ready for the simple tuning operations. As shown in the diagram, each key circuit contains a variable resistor. This resistance controls the tone of the note formed when that particular key is pressed. The resistances should be adjusted until each key, starting at the left, produces a note in the scale.

The master resistance marked A in the diagram, controls the tone of the entire range. Increasing this resistance lowers the entire tone of the scale and decreasing it raises it.

When you play the organ press only one key at a time. In the beginning start with a simple tune, and you will be surprised how easily you can pick out the notes by ear. As each key is pressed, your loudspeaker will reproduce the notes in the rich tremolos characteristic of a fine organ.



Adding a Microphone to Your Set



By John Carr

With a microphone hooked into your set an announcement can be made during the program.

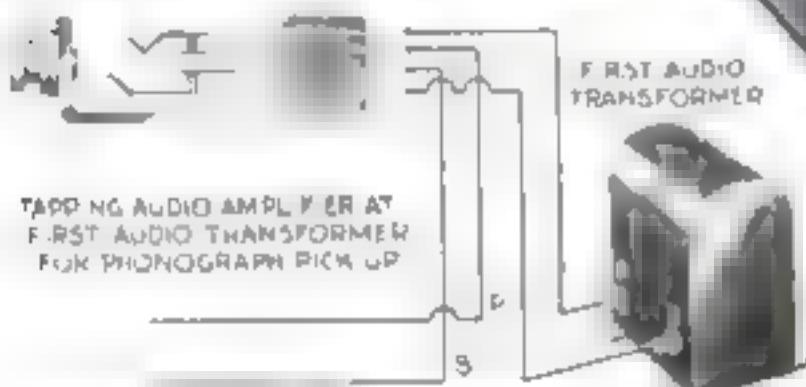


Diagram showing how to tap the audio amp after the audio transformer when connecting phonograph to set.

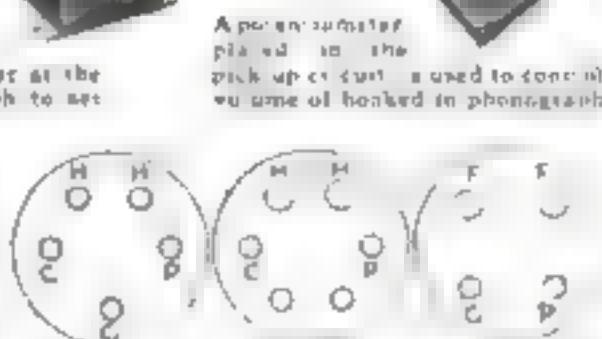
WHEN a good loudspeaker and amplifier system is needed, the radio fan need look no further than the carefully designed circuit of his broadcast receiver.

Attachments like miniature microphones and photographic pick-ups that require an amplifier can be wired directly to a receiver's audio circuit.

Although connections could be made by hunting out the first audio transformer, a simpler method requiring no great knowledge of the circuit can be used.

For example, the easiest way to connect a small microphone into the audio amplifier of most receivers is to utilize the connection prongs on the base of the detector tube. Being wired in this way it will not interfere with the regular operation of the set.

If the receiver is wired for electric operation and employs a five or six-prong detector tube, connections generally can be made to the cathode and plate prongs. First, remove the detector tube. If the set is a superheterodyne, remove the second detector tube. Then, bare the ends of the two insulated wires connected to the microphone, twist one around the cathode prong, twist the other around the plate prong, and replace the tube pushpin



Drawing showing position of tube prongs will help you identify them for the connections.

It firmly back into place. The microphone then should be ready for use, although reversing the connections may give better results.

In a similar way, microphone connections to A.C. electric sets can be made to the plate prong and ground and to the cathode prong and ground. Which of the three sets of connections will work best with a particular receiver can be determined only by experiment. Under no conditions, however, make a connection to the ground of a D.C. operated set.

The plate and cathode prongs on the detector in electric sets can be identified by their relative positions on the base of the tube. Hold the detector tube in front of you, bottom side up. If it has five prongs, rotate it until one prong, set apart from the rest, is nearest you. The cathode prong then will be the one furthest to your left and the plate prong will be the



This inexpensive adapter is used to make split cathode connections. The prongs of the detector tube when a phonograph or microphone is being used.

one furthest to your right. If the tube has six prongs, the cathode and plate terminals will take relative base some positions when the tube is held so that the two larger prongs are away from you.

In D.C. electric and battery-operated sets using a detector tube of the four-prong type, one wire from the microphone to the plate prong and the other to one of the large filament prongs. The plate prong will be the one furthest to your right when the tube is held bottom side up, in front of you with the two larger filament prongs away from you.

Although a phonograph pick-up attachment can be wired into the audio system in this same way or into the first audio transformer as shown in the drawings, better results will be obtained if it is connected in series with the grid or cathode circuits of the detector tube. Being connected into the input of the detector better results often are obtained as the tube increases the volume.

When the detector tube is of the screen grid type, the pick-up can be wired in series with the grid cap connection at the top of the tube.

To obtain volume control with an electric pick-up device, a potentiometer (10,000 to 50,000 ohms) should be connected in series with one lead. If desired, an inexpensive combination plug and potentiometer can be used.

If you have no microphone and wish to make announcements during a phonograph record program, you can use a pair of ordinary headphones. Connect the main terminals of the earphones to the amplifier, short circuit the binding posts on one of the ear pieces, and talk directly into the other. A cone speaker also can be used in the same way.



New Radio Tube HAS NO FILAMENT

By George H. Walker Jr.

RADIO tubes, that operate without the usual A or filament current supply, were demonstrated recently to a group of radio engineers.

Having no filament and requiring but a single direct-current source, the new tubes present an interesting contrast to the detectors and amplifiers of present-day radio.

Dr. August Hund, the designer of the tube with no filament, has made tests with hundreds of these tubes of various shapes and sizes. Simplest of all is a small fuse-like tube containing but two internal electrodes and having a third element in the form of a narrow clip or band that is placed around the middle of the glass container. In the photograph above, Dr. Hund is shown holding one of these special vest-pocket size tubes.

The main difference between these new tubes and the modern variety is the method of obtaining the emission of electrons. In the present-day tube, a coated cathode heated by the current obtained from an A-battery is responsible for the necessary electron emission (P. S. M., Dec. '32, p. 61). In Dr. Hund's tube the electrons are formed by the simple ionization of a gas.

The schematic construction of one of the larger filamentless tubes is shown in the drawing. The glass bulb contains neon, argon, or even ordinary air. In the center is a rod-like element that projects up into a hollow metal cylinder whose sides are provided with a series of small holes arranged in lines. It is this combination of elements that causes the ionization of the gas when a high voltage is placed across them. The ionization of the gas produces electrons.

Surrounding the perforated cylinder is a spiral of wire which performs the function of the grid in the modern tube and surrounding this is a second element, wound in a slightly different manner which acts as the equivalent of a plate.

In use, the large filamentless tube is connected as shown in the drawing. The audio or plate circuit and the electron-



emitting electrodes receive their power from the same direct-current source.

Because of its simplicity, the small fuse-like tube is of special interest. In the diagrams it is shown being used in a one-tube receiver. Incidentally, a tube of similar construction is being used in an experimental one-tube receiver in the photograph in the circle.

As in the larger tube, the glass bulb contains a gas and a high voltage placed across the two elements inside the tube causes the gas to be ionized. The third element, an ordinary battery clip snapped over the glass container at the point where the ionization takes place, is connected into a tuned circuit as shown and sets up an electrostatic field of varying intensity. This varying field controls the flow of current between the two inner electrodes—increasing or decreasing the flow of direct

current through the ear phones according to the fluctuations of the signal. In this way the action of a detector is obtained.

In the laboratory, filamentless tubes have been operated as oscillators, amplifiers, modulators and demodulators. They perform all the functions of the modern thermionic tube.

Having no heated filament, such tubes should have an almost infinite life. In tests, a score of tubes has been operated continuously for hundreds of hours.

The simple construction of the tube and the fact that a cheap gas replaces a relatively expensive high vacuum should, experts feel, make the tube inexpensive to manufacture.

Although these tubes are still in the stages of development, they are a laboratory reality that their designers feel will be a commercial product within a year.

Choose Your SPARK PLUGS to Fit Your Car

By
Martin
Bunn

LATE one Saturday night a short man hustled into the small salesroom adjoining the Model Garage repair shop.

"Got six new spark plugs just like these," he asked, pushing a soiled newspaper package across the counter to Joe Clark.

Gus Wilson, wiping his hands on a piece of waste, poked his gray head through the open repair shop door.

"Hello, Mr. Hardy," he called. "Looks as if you were going to spend Sunday working on your car."

"Just going to put in a new set of plugs," replied Hardy. "These look pretty bad."

Gus picked up one of the old plugs and scraped the tip of the insulator with his thumb-nail. "They're not in such good shape," he agreed. "What type of plug did you buy this time?"

"Why the same kind I've been using of course," replied Hardy.

If your car's in good shape, that's O.K.," nodded Gus. "But sometimes, particularly after the car gets old, a different type may work better."

Gus reached across the counter and selected several plugs from a iron metal rack on one of the stock shelves.

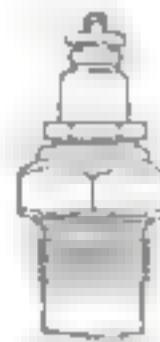
"You know," he said, "manufacturers make a lot of different kinds of spark plugs now—hot plugs, medium plugs, and cold plugs. One concern makes eight types for automobiles, each for a different temperature range."

"Some new scheme to sell more spark plugs," said Hardy sarcastically.

"NOPE, it's on the level. If your motor runs cold and your plugs foul, you need a plug that runs hotter. On the other hand if you get pre-ignition knocks and the motor overheats, a colder plug may help. Of course, if your motor's in A-1 shape you can keep on using the same type of plug that was in the car when you bought it."

"How can one plug be hotter than another?" demanded Hardy. "Is it the spark that's hotter?"

"The spark hasn't anything to do with



"Hello, Mr. Hardy." Gus said. "Looks as if you were going to spend Sunday working on your car. Just going in to a new set of plugs," was Hardy's answer.

"I know," Gus explained, picking up one of the new plugs from the counter. "A hot plug has a larger body inside the cylinder. Naturally, it runs hotter than a plug of the colder type. A hot plug burns off the excess oil and keeps the tips cleaner in a motor that runs cold."

HARDY examined the plugs closely. "Of course," Gus continued, "ten thousand miles is about all you can expect to get out of any set of plugs. And you'll only get that if they're kept clean and are adjusted now and then."

"Say, that stone crusher of mine has been pounding some lately. Maybe colder plugs are what I need," Hardy said thoughtfully. "I think I'll try a set. By the way, Gus," he asked as he stuffed the six new plugs into his coat pockets. "Is there any trick about cleaning plugs?"

"None, if you're careful. After all, only about four things can happen to a plug—the insulator tip can foul with oil and soot, the points can burn or foul, the air gap can be wrong or the insulator can get damaged," Gus enumerated. "You never want to scrape the carbon off the insulator. Wash it off with gasoline. If you scrape it with a knife, nine times out

of ten you'll chip the glaze on the porcelain and the insulator will leak electricity."

"A safe way to clean plugs is to use an old stiff-bristled toothbrush dipped in gasoline. To clean the points, take a small square of emery cloth doubled over so the abrasive is on the outside. That'll sharpen the points easily."

"How about testing the thickness of the air gap?" asked Hardy.

"That depends on the car," replied Gus. "The gap should be set to the specifications given for the motor. It's different for almost every make of car. If the gap's too wide, the motor will run on long, heavy pulls at slow speed. If it's too narrow, you'll have trouble at high speed."

"DO BAD plugs always show up in the way the motor runs?"

"Not always. You can have six bum plugs in your car and still think that it's running O.K. But you'll find a big difference in the amount of gas you have to buy."

"That's right," interrupted Joe. "Henry Dunham put a new set of plugs in his last month and claims he's getting two or three miles more out of every gallon of gas."

"I don't see how you can tell whether a spark plug is any good," put in Hardy. "They all look the same to me."

"You can find (Continued on page 111)



MODEL MAKING : HOME WORKSHOP CHEMISTRY : THE SHIPSHAPE HOME

How to Build a Colorful Model of the FAMOUS FIGHTING GALLEON

"REVENGE"

BY CAPTAIN
E. ARMITAGE McCANN

OUR new ship model is an Elizabethan galleon, the *Revenge*—as picturesque and colorful a little fighting ship as ever battled on the high seas.

The *Revenge* lasted only from 1577 to 1591, but she earned undying fame. Under Sir Francis Drake she covered herself with glory in the defeat of the Invincible Spanish Armada. Her greatest fame, however, was gained under Vice-Admiral Sir Richard Greenville in a battle off Flores in the Azores. All alone, she fought for a day and a night fifty-three Spanish galleons and finally surrendered under terms. She was later lost in a storm.

This model can be very gay without taking any liberties with the facts. Though it is essentially correct for the period in design and the like, its hull is built in easiest possible manner from a jug-seen aboard and two side blocks. Rigging too, is somewhat simplified, though it appears to be complete as complicated.

All together, the model is a much simpler one to build than those we have been describing for some time past. Our models have been made more and more elaborate and exact in details. This is as it should be because it means progress, but those who have lately taken up ship model making, as well as advanced workers who wish a change from more difficult tasks, will find this new model much easier to construct than such ships as the whaling bark *Wanderer* and more colorful than U. S. Navy ships like the *Texas*.

The *Revenge* was known as a "great ship of the second sort." She was rated as of 500 tons, with dimensions about a





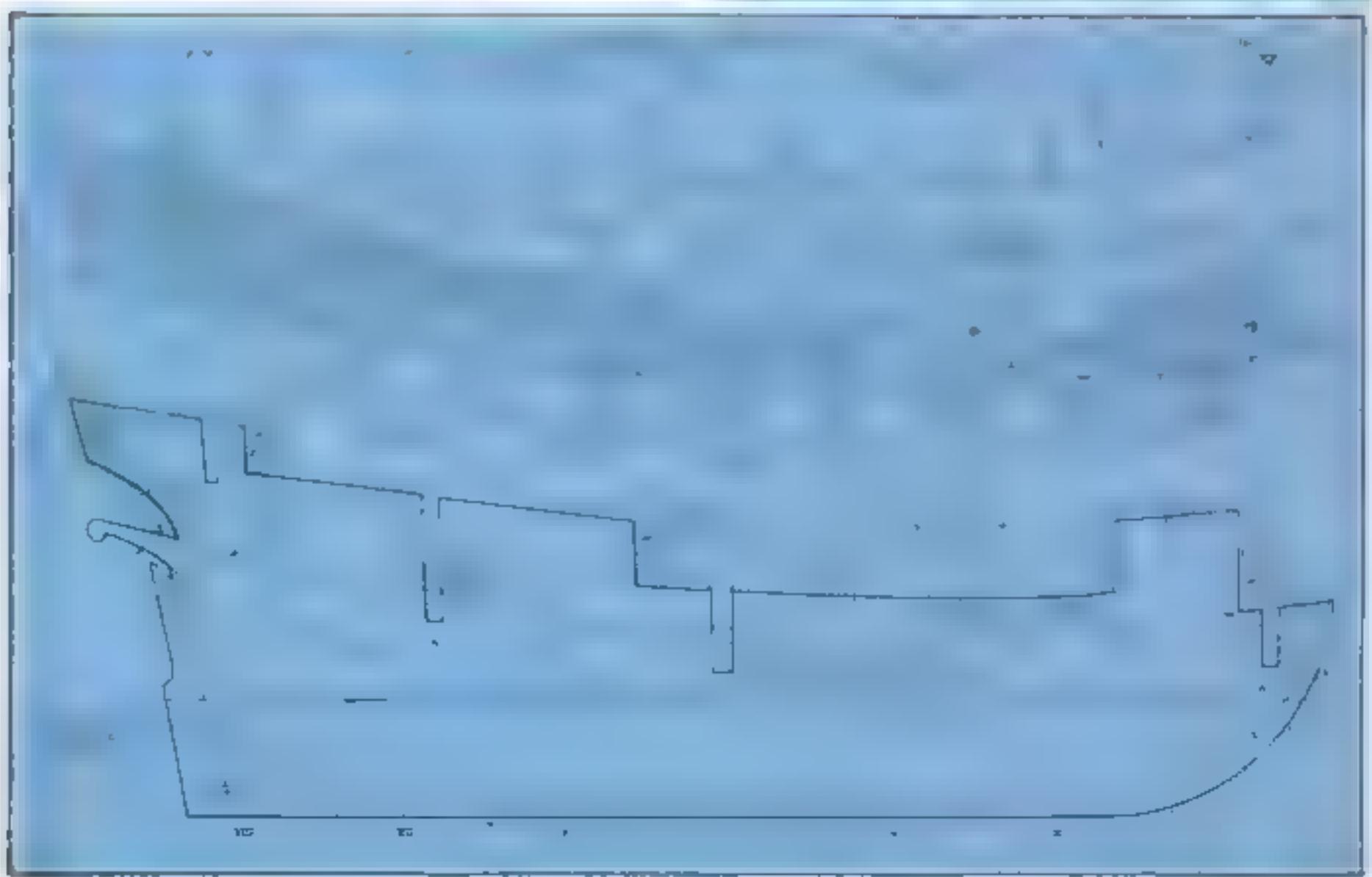
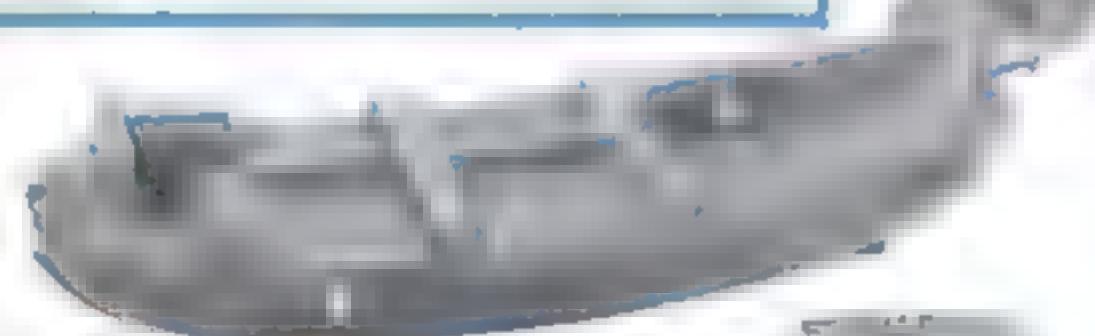
Photo by Author

The length of hull is about 32 ft., width 15 ft. The model is 1/24 scale and 25 in. high.

A good example of what may be done.

The model shown here was built by Drake as a piece of naval construction. The Spanish galleons were bigger and heavier but were invariably beaten by the English because the latter were better handled by real sailors.

To make this model it is best to have full sized drawings which can be enlarged from those given here. It is of course easier and more satisfactory to obtain blueprints that are



This drawing gives the dimensions of the hull. Center part A is 10 ft. wide, B is 15 ft. wide, C is 25 ft. long, D is 10 ft. long, E is 10 ft. long, F is 10 ft. long, G is 10 ft. long, H is 10 ft. long, I is 10 ft. long, J is 10 ft. long, K is 10 ft. long, L is 10 ft. long, M is 10 ft. long, N is 10 ft. long, O is 10 ft. long, P is 10 ft. long, Q is 10 ft. long, R is 10 ft. long, S is 10 ft. long, T is 10 ft. long, U is 10 ft. long, V is 10 ft. long, W is 10 ft. long, X is 10 ft. long, Y is 10 ft. long, Z is 10 ft. long.

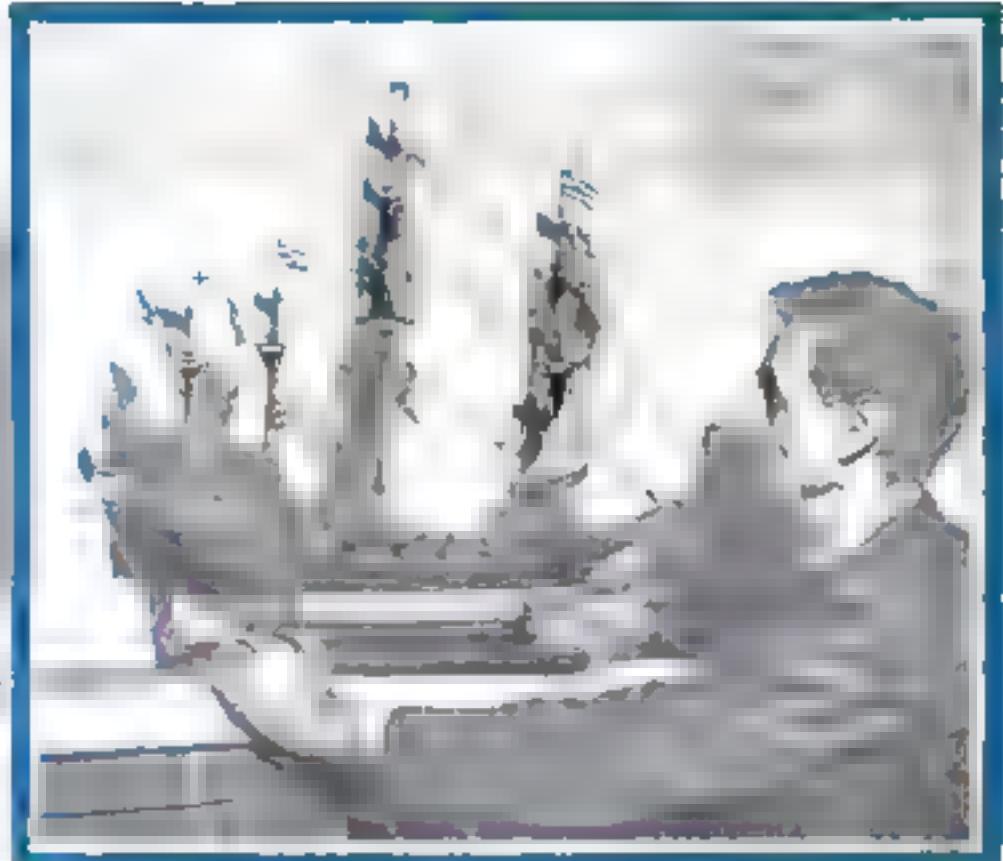
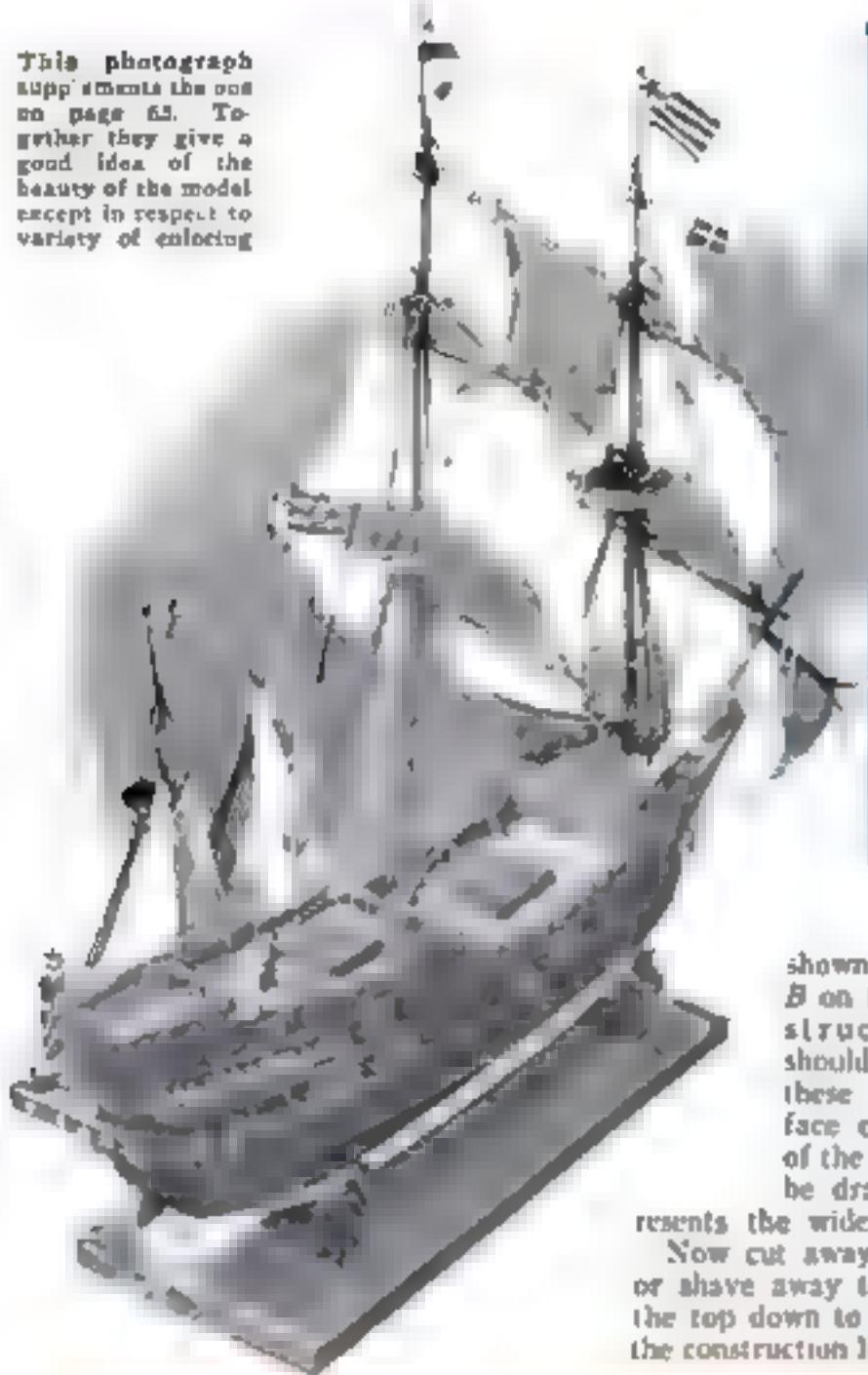
built by this method. A piece of wood 21 in. is required. This is marked with a vertical line shown in the drawing. The dots in it are to show where the planks can be put together to represent the hull.

All wood must be well dried and a strong glue used.

Now cut out Part C and set aside.

Next, two pieces of wood or other soft wood 4 by 4 by

This photograph
supplements the one
on page 63. To-
gether they give a
good idea of the
beauty of the model
except in respect to
variety of coloring.



Captain McCann gives the *Raven* a final inspection as he places it on the mantel. In fact the model is well suited for the average room.

shown by the dash lines marked B on the sheer plan. The construction lines II to VIII should be drawn right around these pieces. On the top surface of each the outside line of the half breadth plan should be drawn—the line that presents the widest part of the hull.

Now cut away to the profile, and cut or shave away to the breadth line. Cut the top down to the sheer line. Re-mark the construction lines. With dividers, mark

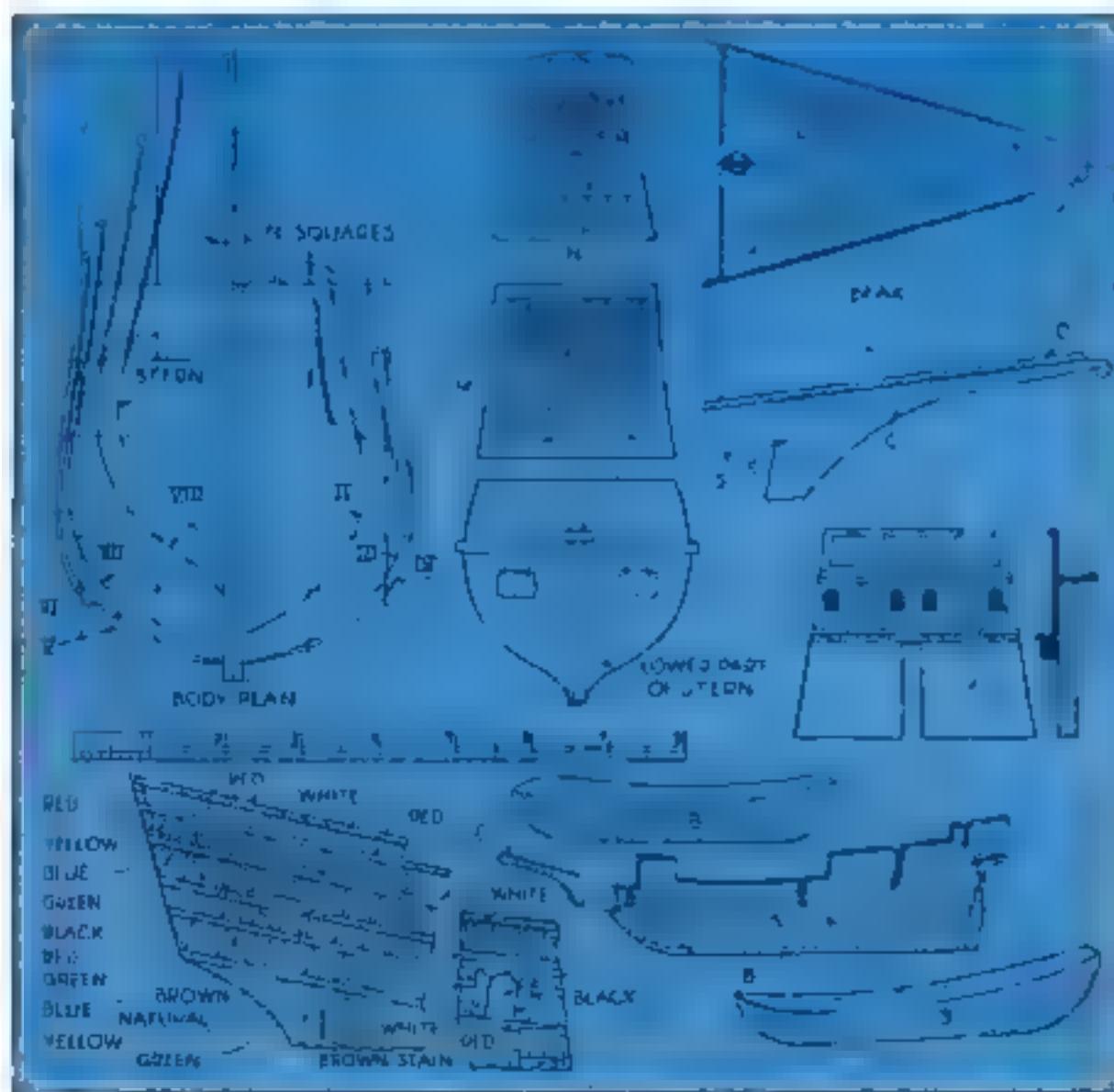
In the top of B. On the side, mark the line of greatest beam. Shave away from that to the top of B to form the tumble-home.

On pieces of cardboard make a series of templates from the body plan, but only to the top of the heavy lines there shown; the double lines above represent the bulwarks. Shave away each sidepiece *B* until the templates fit at their respective stations. Be careful to hold the templates at a right angle to the block. Note the bluff, rounded bow and somewhat hollow part under the stern.

From the plan, mark the outline of *B* on both sides of *A*, then glue on and nail these sidepieces. One side can be nailed through *A*, the other can have a few nails toenail in.

Cut the beakhead C with the grain lengthwise. Make an oblong slot in it for the gammoning (bowsprit lashing), and bore a hole for the forestay. Make a V-cut at each side to mark the continuation of the stem. Glue this piece carefully.

Cut the deck (Continued on page 91)



The body plan, details of beak, billhead *J* and overlay *I*, stern boards *M* and *Q*, and lower part of stern, and an explanatory sketch. The scale applies to all drawings but the sketch.

KEY TO DRAWINGS

The parts of the *Revenge* model have been given the following identifying letters on all the drawings that are to be used throughout the series.

A	Centerboard	H	Forecastle deck
B	Side blocks	N	Stern board
C	Beak	O	Bulwarks
D	Beak deck	P	Beak bulwarks
E	1st bulkhead	Q	Under stern board
e	Overlay for E	R	Stern gallery
F	Main deck	S	Bowrie holes
G	nd bulkhead	T	Channels eight
g	Overlay for G	U	Forehead
H	rd bulkhead	V	Stern lantern
b	Overlay for H	W	Ha - bies
J	4th bulkhead	X	Knights
j	Overlay for J	X	Gathards
K	Quarter-deck	Y	Ladders
L	Poop deck	Z	Guns

Also, not lettered, four flags and staves, anchors, base. Parts are listed as nearly as possible in the order in which they are applied to the model.

REMARKABLY LIFELIKE LITTLE Dogs made from Pipe Cleaners

You have probably seen numerous little animal novelties made by twisting pipe cleaners together. In most cases they are comical enough, but still and grotesque—almost clownish. It is therefore a revelation to see, from the illustrations accompanying this article, what lifelike results can be obtained by one who is skillful at this pastime.—THE EDITOR

IN MAKING novelties from fuzzy pipe cleaners, it is perhaps best to start with a simple dog animal like the one shown. If you have a few cleaners and a pair of pointed nose pliers, you have everything necessary for your initial attempt. When you have completed a natural-looking little dog, it can be used as an ornament on a radio cabinet, desk, or occasional table.

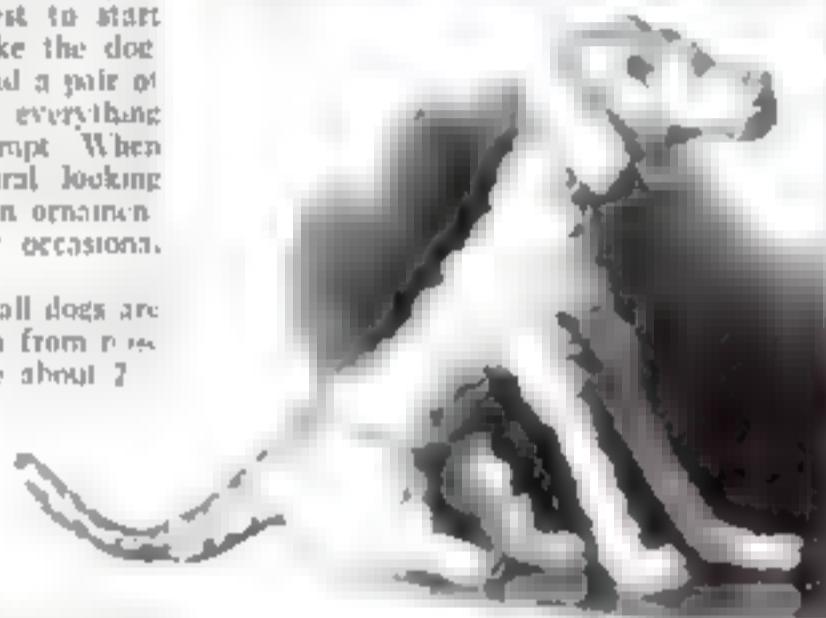
The size is optional, but small dogs are easier at the start. The length from nose to the end of the tail may be about 7 in., and the height 1 in. Bend a cleaner to form one curved piece from the muzzle to the end of the tail. Let it be long at the nose end, you can cut the surplus off later when the length of the muzzle has been determined. You may leave the tail straight if you prefer it that way or double it back to make it more stocky.

Now fasten the end of another cleaner securely at the base of the tail and wrap it tightly around the main part of the skeleton to form the body. Twist this tightly, putting one turn close against the other and wind on another layer or two to build it to the right thickness.

The ears are formed from a single piece doubled in two places and fastened at the top of the forelegs. Wind another layer over this, starting at the front shoulders, to make the neck. Crisscross the turns between the ears to hold them in place. Then wind the muzzle, the length depending on the breed of dog you



This group illustrates what can be done with ordinary pipe cleaners when properly twisted



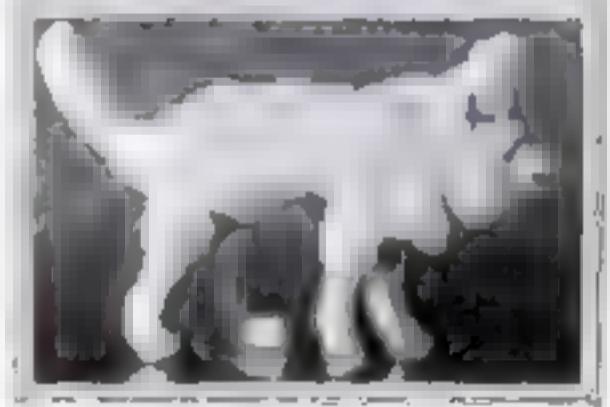
A pipe-cleaner dog that looks real enough to bark and at right, three views showing the steps to follow in making a typical dog

modeling. It will be necessary to wind more than one layer on the neck and muzzle to build up the thickness.

Any short pieces left over will do to wind high up on the legs, close to the body. Then clip the legs off the correct length and bend to their natural form.

The eyes and nose may be indicated with ink spots, or small glass-headed pins cut off short and with a touch of glue on them, may be used for eyes. A slight twist to the head will give the completed dog a natural expression.

Practice and close observation are the secrets of success.—WILLIAM F. HILL



FUNNEL ACTS AS HOLDER FOR A FLASHLIGHT

AN ORDINARY flashlight is sometimes the only source of light available for unexpected repair jobs about the home. To keep it spotted right on the work, if you have no one to hold it for you, is not an easy matter but it can be done by using a funnel as shown at the left. Tie together the ends of a piece of string about 8 or 9 in. long and loop it around the light and the spout of the funnel so that you can shift the flashlight to any desired angle. It is surprising what a large range of adjustments can be obtained by using this simple expedient, and it is almost always possible to obtain a funnel.—F. W. B.

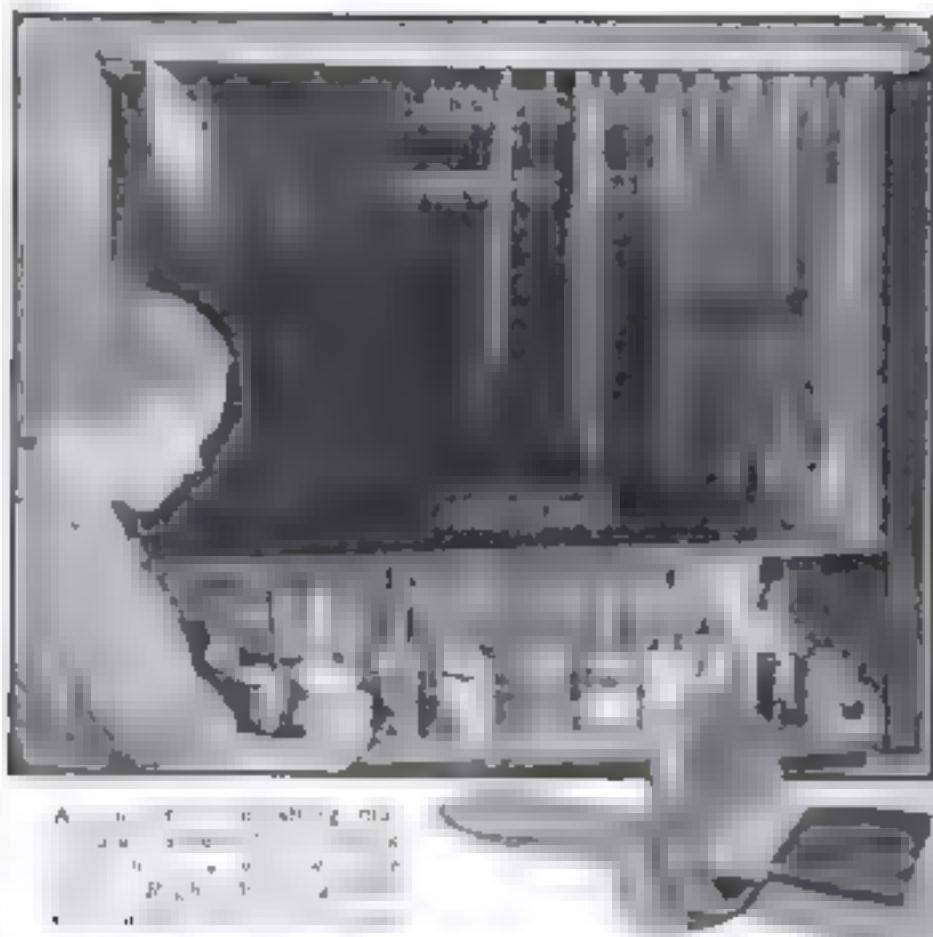


Toy aviator mounted so it can be ridden

MOUNTING TOY PLANE

A DISCARDED set of toy chime wheels and an old airplane toy, if placed at opposite ends of a 3-ft. length of broomstick, will give a small boy many hours of fun playing aviator. It is best to mount the plane at such an angle to the stick that it will be approximately horizontal when the boy gets astride or "rides" the broomstick.—D. A. BUTLER

How to Keep Paintbrushes so They Never Need Cleaning



With a relatively small amount of various lacquers, paints, or other finishing materials are used, as in a home workshop, a school shop, or a small repair shop, it saves much time to set a brush through a slot in the lid of each can and hold it in place as shown in the accompanying illustrations. Obviously, the brush will be used only for the one kind of paint or lacquer and therefore will not have to be cleaned. When one can is used, another full one is substituted. For identification, the handle of each brush is given a coat of the liquid within the can.

Note that the slot in the lid is cut off center and near the edge. This gives better visibility in using the brush, and when the brush is laid down, the tip is held clear. Furthermore, the brush will not roll but will come to rest in the position shown in the smaller photograph.

The wooden cabinet shown in the large illustration is about 4 by 4 by 1 ft. and contains three shelves. On the upper shelves are stored lacquers, oils, varnishes, paints, cements, glues, and pastes. On the bottom shelf are kept the brush cans and other materials often used. The front of the cabinet is a retrieved window-shade roller on which has been placed black oilcloth. It is mounted so as to slide up and down between guides. This is the simplest and cleanest method the author has seen.—B. T.



REPAIRING OLD WRINGER

THE staining and discoloration of clothes by an old, nearly worn-out clothes wringer is usually caused by rust from the iron roller cores, where the rubber has loosened at the ends and allowed water to run in. A quick repair can be made by taking out the rollers, fastening a paper collar about the ends, and pouring in melted paraffin to seal the openings against water and rust. If the stains are caused by grease or oil from the gears and bearings, clean these parts with gasoline and grease lightly with vaseline.—P. W. STAPP

STORAGE BOX PROTECTS CIRCULAR SAWS

AS THE HOME CRAFTSMAN extends his activities, he is likely to accumulate several circular saws and possibly an abrasive metal cutting wheel. He may hang these on nails, where they are subject to deterioration from rust and dust, or stack them on a shelf where they are awkward to get at and are likely to have the sharp

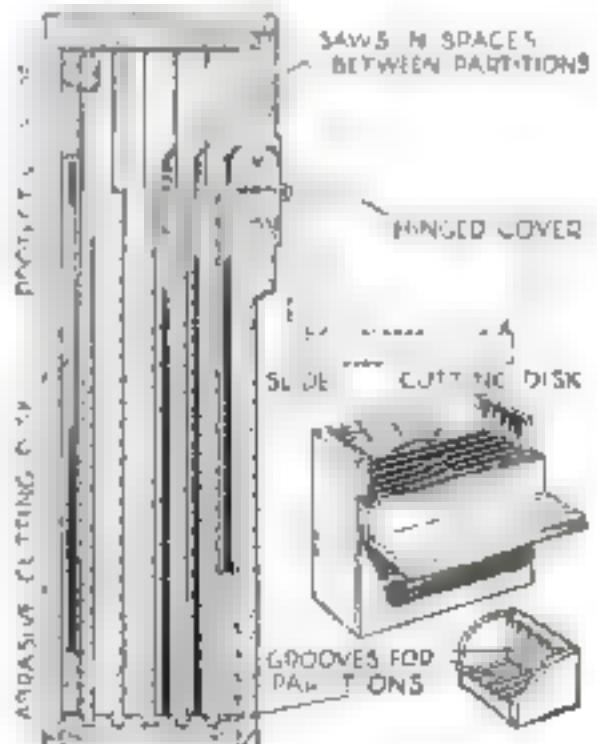
points knocked off or otherwise damaged.

In one case the problem was solved by making a box with partitions as shown. It was mounted conveniently on the frame that supports the saw unit. A special feature is the slide of 3/16-in. plywood with a large hole cut in it to hold a thin abrasive cutting wheel. The slide, with the disk in it, is placed in the rear compartment.

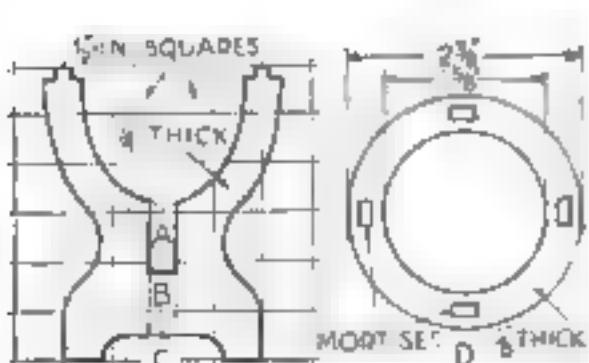
The drawings below give the details of construction. A horizontal section through the side would be similar to the vertical section at the bottom. No dimensions are given, as the box should be designed to suit individual needs. The sides, bottom, and toppiece of lid may be 1/2 in. thick wood, but 1/4-in. plywood is better for the front and back, and 3/16-in. plywood or thin synthetic wood for the partitions.—DONALD A. PRICE



Box with special holder for an abrasive disk



A vertical section through the box and two thumbnail sketches to explain construction



The two upright pieces are notched and half lapped together and the ring is glued on top



This egg holder makes a novel Easter gift for any child. Cut two pieces like C from 1/4 in. three-ply veneer. In one of them cut the slot marked A; in the other the slot indicated by the dotted lines at B. Make the ring D from 1/8-in. stock and cut out the four holes or mortises as shown to match the small tenons of C. Glue the three parts and paint gayly.—W. HARVEST

Portable Air Compressor

WHEN we asked our readers recently for suggestions on making use of old auto engines and offered a few prizes as an inducement for them to sketch out their ideas, we had no expectation that so large a variety of excellent plans would be offered. In both number and quality of entries, the contest was extraordinarily successful. Not only was great mechanical ingenuity displayed throughout the entire range of entries, but in many cases even the method of presentation was noteworthy, either because of fine craftsmanship or unusually clear descriptive text.

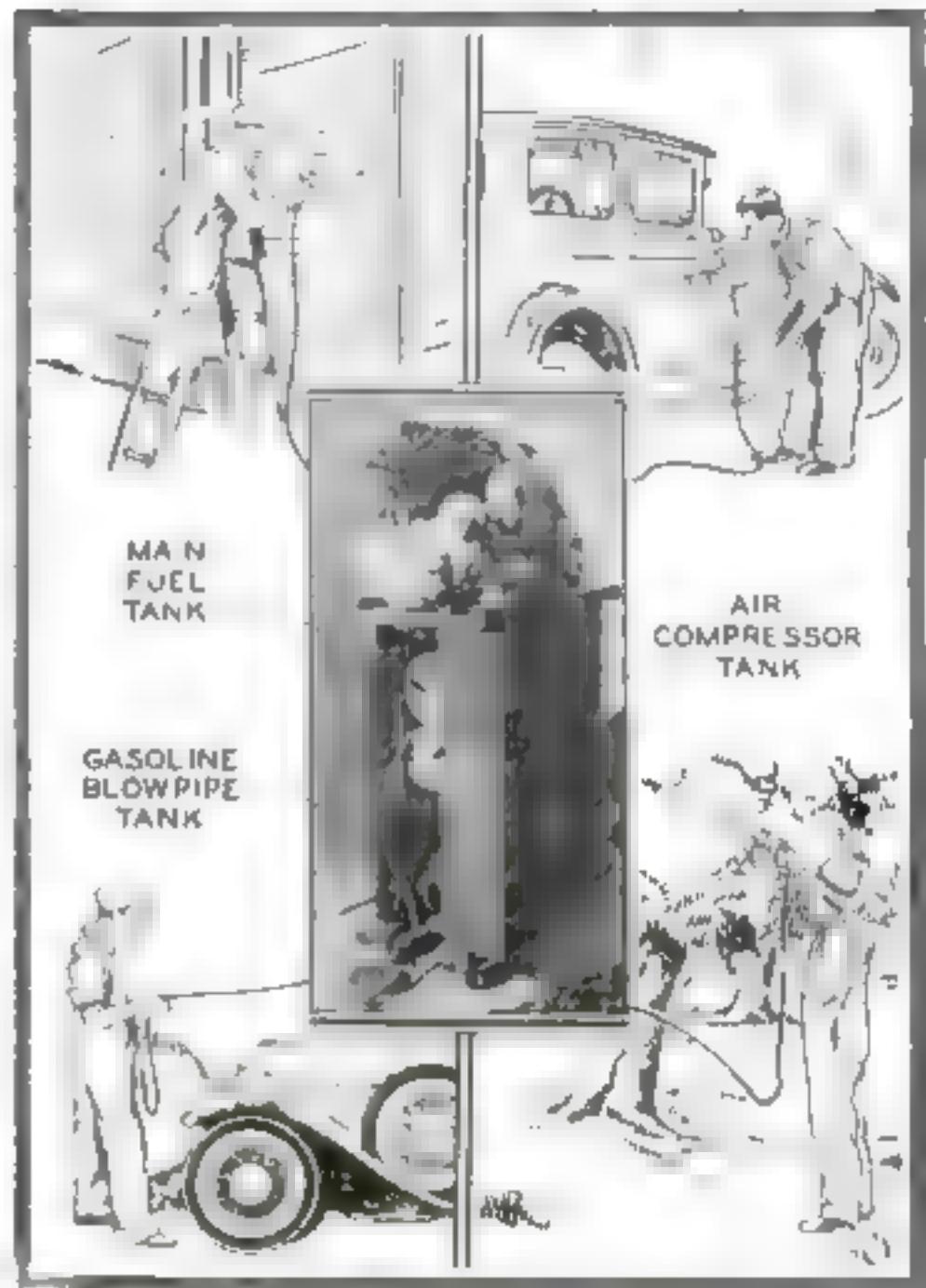
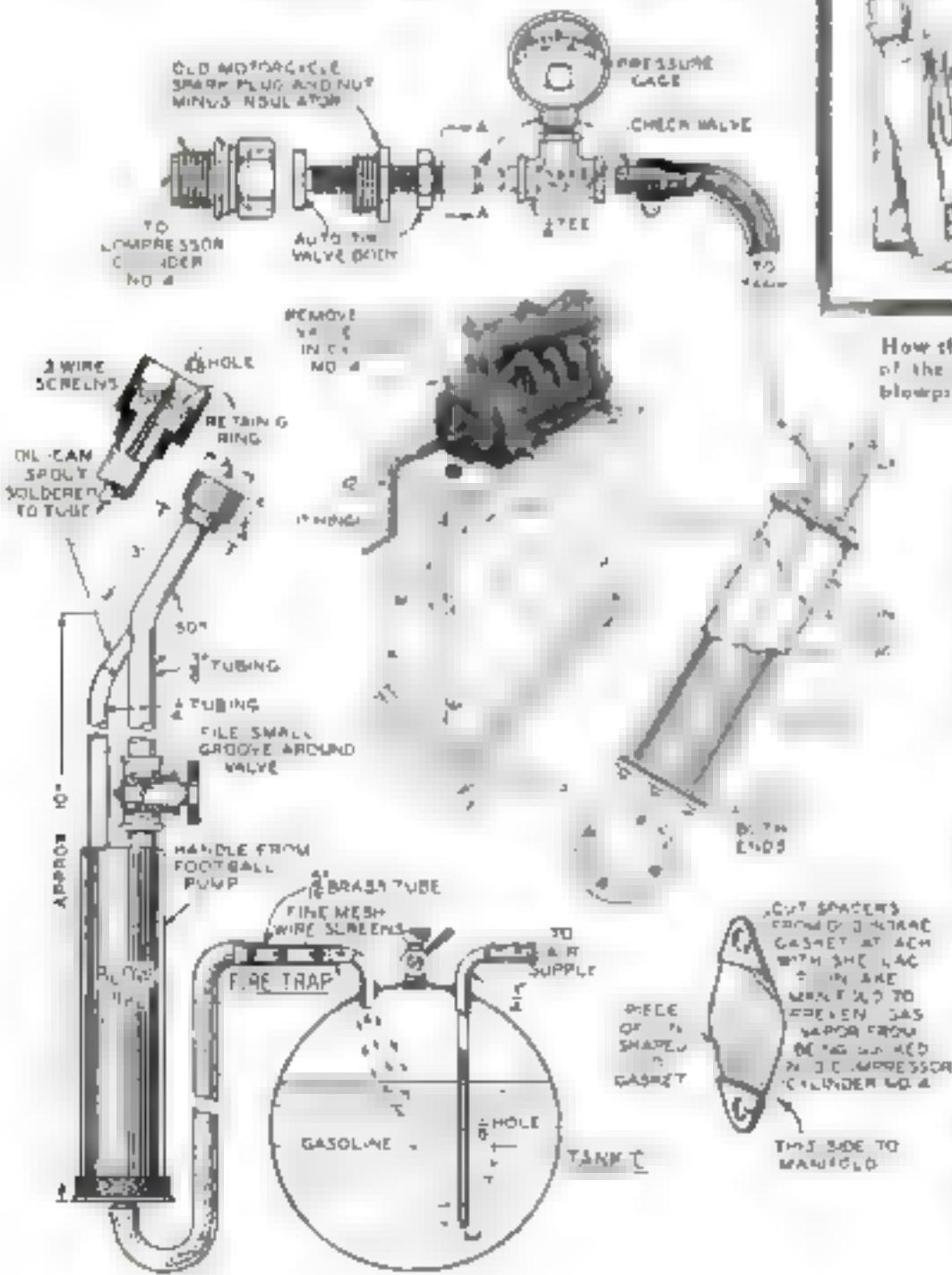
The prize winners are listed on the opposite page. A glance at this long tabulation will show the principal types of uses to which old engines are applied. Many of the contributions were accompanied by photographs showing actual installations, although this was not required by the rules of the contest (P.S.M., Oct. '32, p. 60).

To choose the best entries when so many were of such a high degree of excellence was a difficult task. Long as the list of awards is there were scores of other projects which were separated only by a narrow margin from those that were given honorable mention.

The accompanying illustrations of a portable air compressor were submitted by J. G. Marinac, of Plainfield, N.J., who was awarded first prize. The second and third prize winning projects and, if space is available, a few of the other outstanding entries will be illustrated in following issues.

Mr. Marinac's description of the compressor follows:

In the January 1929, issue of POPULAR SCIENCE



How the converted motorcycle engine is mounted, and details of the air receiver B, the air line and check valve, and the blowpipe and its gasoline tank C. The outfit has many uses

MONTHLY, an article 'Makes Paint Sprayer at Small Cost' was published. This was just the type the author required and he built the device, but the problem was the air pressure. Air compressors for the workshop or home garage are seldom found. After the air problem had been solved as shown in the accompanying illustrations, numerous uses for this outfit were found. The construction is fairly simple, and if one has no engine, an old one can be purchased at a low price.

"A four-cylinder motorcycle engine is preferable since better economy and very silent operation are obtained compared with an auto engine of similar size, and the air cooling is an advantage in respect to portability. The balance of the material is generally to be found in the home workshop.

"To use the engine as a power compressor, a few simple changes are necessary after the transmission clutch etc are removed. By removing the short clutch shaft from the flywheel, a crank may be inserted for starting. The crank handle is an auto brace used to tighten nut-clamps on auto wheels; it is notched in the end like a ratchet tooth to engage pins in the flywheel. Cover the transmission opening with aluminum or tin plate so that oil does not leak out.

"Cylinder No. 4 is the air compressor. Remove the exhaust valve tappet in this cylinder, as it is not used. The tappet itself need not be removed—just the adjusting lock nut and screw so that it does not lift the valve up at all. The inlet valve is used 'as is' and delivers compres-

for Shop Use

MADE FROM DISCARDED MOTORCYCLE ENGINE

AWARDS in the *Old Auto Engine Contest*

FIRST PRIZE, \$25

J. G. Marinac, Peained, N. J.
for portable air compressor

SECOND PRIZE, \$15

J. C. Miller, Parsons, Kans.
for combination tractor and power plant

THIRD PRIZE, \$5

Walter A. Papworth, Syracuse, N. Y.
for motorboat installation

FIVE PRIZES, \$1 EACH

J. G. Barber, Medford, Ore., *for power auto belt take-off*
J. L. Bird, Paterson-Radburn, N. J., *for electric power plant*
Robert A. Gregory, Nampa, Idaho, *for drag-line hoist*
Frank J. Orrell, Youngstown, Ohio, *for arc welding outfit*
Paul Sager, Coleman, Wis., *for water pump and lighting plant*

HONORABLE MENTION

Air compressors—Fred Akire, Santa Barbara, Calif.; J. and R. Hammock, Seattle, Wash.; Robert M. Norris, Marquette, Kans.; Roland Ford, Alameda, Calif.; F. E. Wise, Cleve and Heights, Ohio; Charles R. Womack, Jacksonville, Fla.

Boat power plants—Isaac R. Eby, Elizabethville, Pa.; Howard F. Hammerer, Ottawa, Ill.; Ray E. Stephenson, Dixon, Ohio.

Feed grinders—Harold Capris, Napoleon, N. D.; Forest Crosson, Boulder, Colo.

Miscellaneous—Keith Cooman, Tacoma, Wash., *for logging locomotive*; William Lubrano, *for an auto gas engine*.

yellow pine according to the dimensions in the drawing with molding at the base to cover the joint. A door at either end is optional with the bender. All joints are screwed and glued. The tanks are supported on wooden cleats. Large iron casters aid in moving the outfit about the work.

Fred Akire of Santa Barbara, Calif., another contestant built his first air compressor from a junked valve-in-head Chevrolet motor. He overhauled it, installed new rings, cut off the top of an old piston just below the third-ring groove, and attached this extra length to the piston in the front cylinder of the motor, leaving all the rings in place. This added length fills the combustion space completely when the piston is at top stroke and forces the air completely out of the cylinder into the air receiver—in this case an old ammonia cylinder bought in a junk yard for a dollar.

"I took off the push rods to the inlet and exhaust valves in the front cylinder," Mr. Akire wrote, continuing his description. "The inlet valve was not used except to keep the inlet port closed at all times. The exhaust valve was fitted with a very light coil spring and acts as a fresh air intake. This must not, however, draw any of the burned exhaust gases from the other three cylinders. In the first compressor I obtained an old three-port exhaust type cylinder head, which allowed the exhaust manifold to be set back from the front cylinder."

"The present type of Chevrolet head can be converted into the proper form by boring a $\frac{1}{2}$ -in. hole through the front water connection plate and also through the inner water jacket head, the hole terminating in the front exhaust valve pocket. Fit a piece of $\frac{1}{2}$ -in. outside diameter brass tube into this hole and pack it carefully with plaster of Paris so that no water will circulate near the tube or the holes. This tube is the fresh air inlet. The passage in the head from this front valve pocket is sealed from the other exhaust gases by packing in a handful of plaster of Paris mixed with tow.

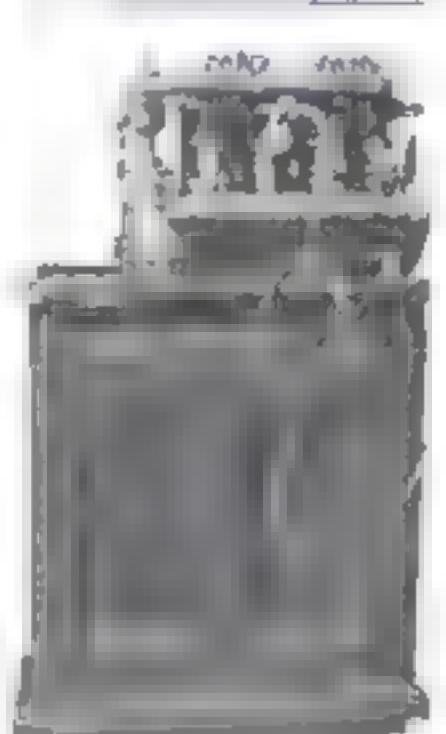
"The compressed air is taken from the cylinder through the regular spark plug opening. I took an ordinary spark plug removed by its own center and welded a $\frac{1}{2}$ -in. pipe coupling on so that a $\frac{1}{2}$ -in. pipe could be connected for testing the air to the receiver. I made the check valve from a piece of cold-rolled nickel steel and tapered the edge of the head so that it would seal against the tapered part of the spark plug. I bowed the guiding part of this valve into a three-cornered shape so that the *valve seat* fits tightly.

"Hand pump D, which supplies pressure feed to the carburetor, is a small bicycle pump. Main fuel tank A and tank C are made from a piece of galvanized stovepipe 6 in. in diameter. Tank A is 20 in. and C is 4 in. long. Both have the ends soldered to withstand pressures up to five pounds. Tank B, the drawing of which is self-explanatory, has $\frac{1}{2}$ by $4\frac{1}{4}$ in. disks at the ends, with rubber gaskets for pressure.



One of the most obvious and practical uses for an air compressor of this type is in a small service station or repair shop where expensive equipment is not warranted and portability is desired.

Another view of the portable air compressor. In the majority of cases, an auto engine is used, but J. G. Marinac the builder of this outfit prefers a motorcycle engine because it is more economical and easier to move about.



every other revolution through the sparkplug outlet, modified as shown in the drawing. If compression is required at every turn, then the intake mechanism is removed and a finer spring used so that it opens automatically. This must be decided by the constructor. The former method permits the engine to run smoother, and cylinder No. 4, cooler.

Gas vapor is blocked from entering by the gasket shown. This insures pure air in the intake. The exhaust muffler is stuffed halfway with coarse steel wool as an additional aid to silence.

"Hand pump D, which supplies pressure feed to the carburetor, is a small bicycle pump. Main fuel tank A and tank C are made from a piece of galvanized stovepipe 6 in. in diameter. Tank A is 20 in. and C is 4 in. long. Both have the ends soldered to withstand pressures up to five pounds. Tank B, the drawing of which is self-explanatory, has $\frac{1}{2}$ by $4\frac{1}{4}$ in. disks at the ends, with rubber gaskets for pressure.

The gasoline blowpipe is an asset to any home garage. It may be used for soldering radiators and storage battery cells, for brazing, and for removing fender wrinkles.

Four $\frac{1}{4}$ -in. bolts hold the engine to the 1 in. square wooden engine bed. The engine bed and base are made from 1-in.

THIS STRIKING LITTLE Autogiro Model

Needs only a few simple parts

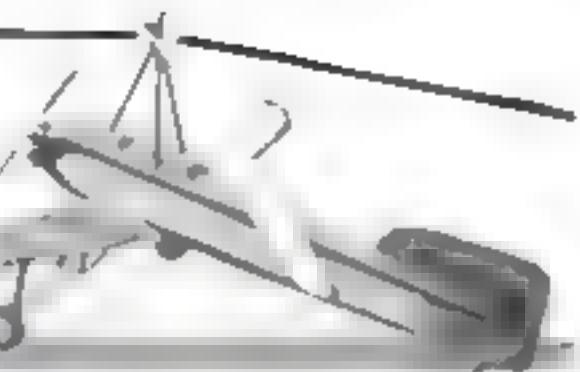
BECAUSE of its curious appearance and remarkable performance, the autogiro has an especial appeal for the airplane model builder. It would seem an unusually difficult model to make but this is not the case if the accompanying plans are closely followed. There are but twenty-six parts to this design and most of them have been left off to simplify the work although they can be added if desired. The scale of the model as compared to a real autogiro is $\frac{1}{8}$ in. equals 1 ft.

Balsa wood can be used, but I have found on many white pine an excellent material for fuselage, wings, wheels, and other wooden parts. Thin aluminum or copper is best for tail surfaces, struts, and propellers.

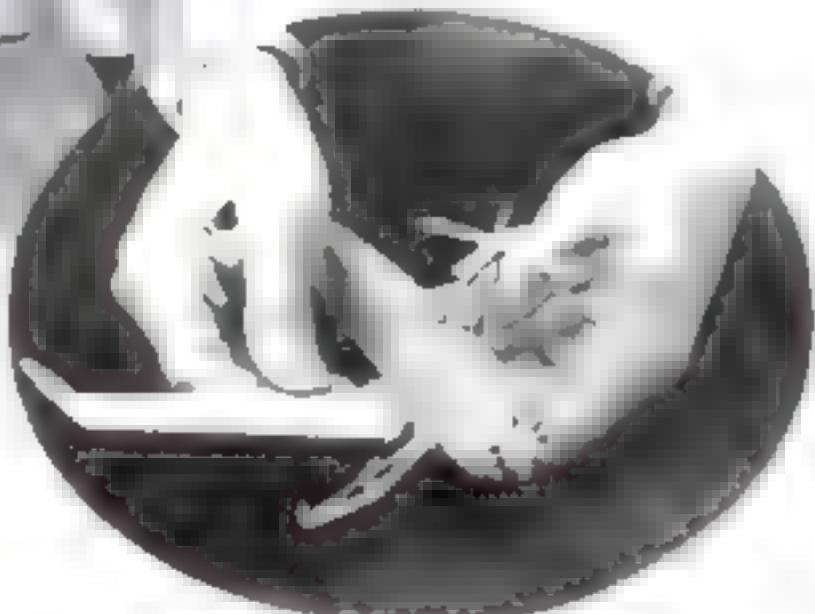
Cut the fuselage from a white pine blank 1 by $1\frac{1}{8}$ by 8 in. on which the lines of the body design have been drawn. Mark and saw the tail plate before tapering the fuselage. Drill $\frac{3}{16}$ -in. holes for the engine cylinders, which are merely

$3\frac{1}{4}$ -in. lengths of $\frac{3}{16}$ in. diameter bolts, glued in. Set four $\frac{1}{4}$ -in. lengths of wire or brads into the sides as shown to serve as dowel pins for attaching the wings.

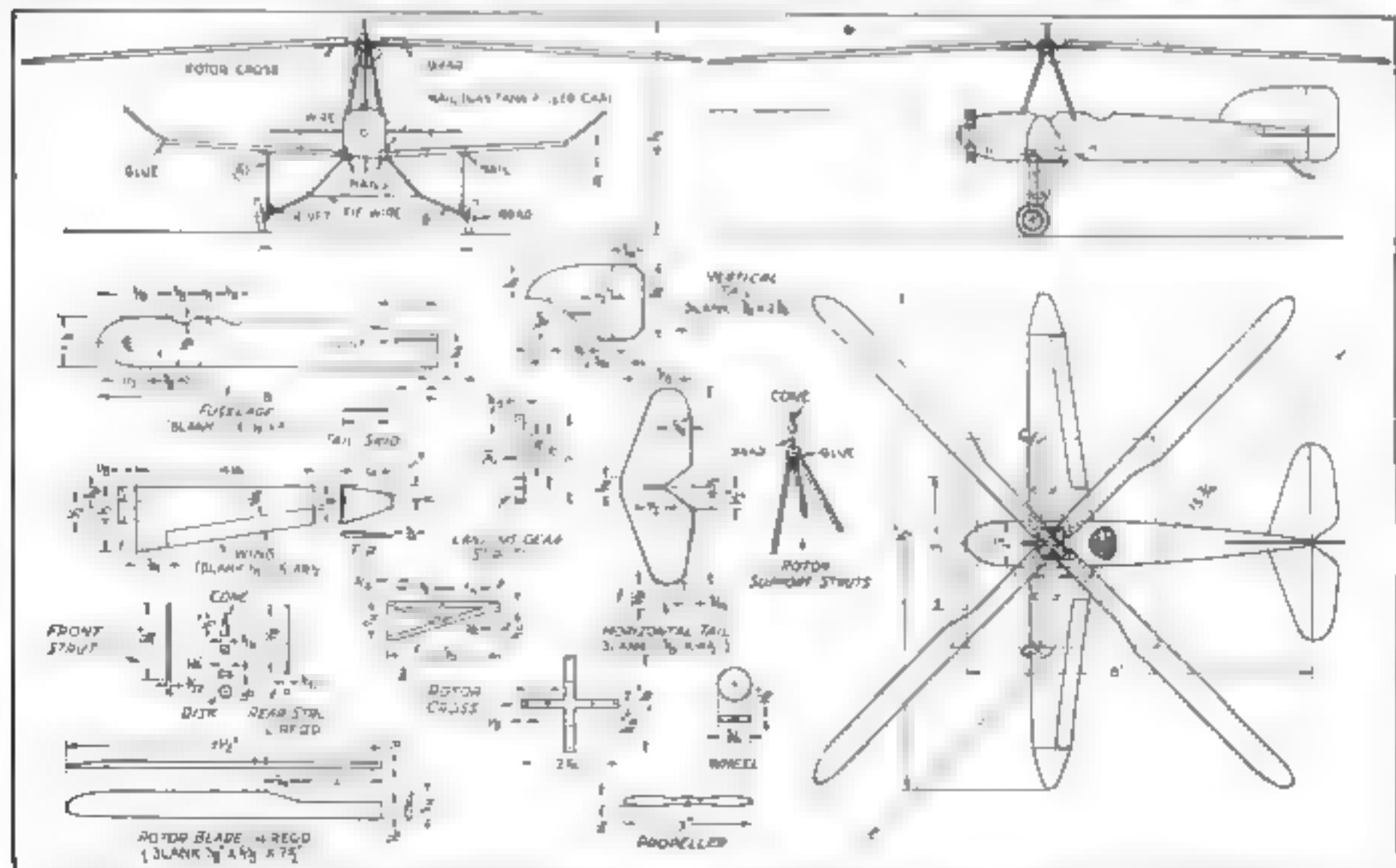
Make the wings from a pine blank $\frac{1}{8}$ by $1\frac{1}{8}$ by $5\frac{1}{2}$ in. long and cut it in two. Shape the tips from pieces $\frac{1}{8}$ by $\frac{1}{8}$ by $1\frac{1}{8}$ in., bevel them to



The finished autogiro model, and at left a complete set of the parts. Note that the diagonal struts of the undercarriage are each cut from a single piece of thin sheet metal.



The wings are attached by means of wire pins. The base plates, which are dotted in the drawings below, are optional.



Front side and top assembly drawings of the model and details of the fuselage, wings, rotor blades, rotor struts, tail units, wheels, propeller and other parts. Because of the large number of dimensions, the various units look complicated, but they are really very simple.

the correct angle, and fasten with glue.

Cut the struts from thin metal, drill and bend as indicated in the drawings, and rivet together. Attach them to fuselage and wings with brads, and connect the diagonal struts with tie-wires as shown in the front view. The wheels are $\frac{1}{4}$ by $\frac{3}{4}$ in. diameter wood; the axles are brads.

Use $\frac{3}{32}$ in. diameter wood for the rotor support struts and set them into the body

with glue. On top of these glue a disk of wood through which is driven a slim brad, point up. A wooden cone slips onto the brad and keeps the rotor from coming off.

The rotor blades or vanes can be made of white pine $\frac{3}{8}$ by $\frac{5}{8}$ by $2\frac{1}{2}$ in., shaped as shown with an airfoil cross section. Fasten them to the metal rotor cross with glue and nails.

The brace wires, which are shown in

dotted lines above the rotor blades, can be represented with thread or fine wire. Stick short pieces of pins into the vanes and tie the braces to these.

The model will look well if painted as follows: fuselage, wings, tail units, and rotor blades, Chinese red; propeller, wheels, and wide stripe on fuselage, white landing gear, struts, tires, motor, rotor cross, and tail skid black.

Wood Carving for BEGINNERS

Two simple methods by which anyone can prepare panels of a decorative character

BY CAROL COWARD

FOR decorative work of a bold and self-expressive type, try carving pictures or friezes from wood similar to the panel illustrated at the bottom of this page and those shown on page 74.

A $\frac{1}{4}$ in. carver's gouge, a veining tool (small U-shaped gouge), and some common paints are sufficient for making a start. Any wood can be used if color is to be applied; otherwise a good, clear straight grained piece of cabinet hard wood should be chosen. Walnut and oak are perhaps the best, at least they are preferred by the author for her own work.

Designs can be traced if drawing is faint, difficult. The drawings on page 74, of course, are too small in their reduced size, but they can be enlarged easily by dividing them into small squares with light pencil lines. Then draw larger squares on the wood and copy the outline free-hand drawing in each of the larger squares what appears in the corresponding smaller square. This method is so simple it hardly needs to be explained.

Ancient Egyptian subjects make fine designs, and Persian, Chinese and Japanese drawings are also



This is a copy of a large figure. She has been carved from a block of wood about 12 in. long.

available. Museums supply illustrations of jugs, can and other antique subjects at nominal prices. Designs for modern work such as樵夫 (樵夫), plowmen, fiddlers, or boxers will appeal to many. For these illustrated papers and magazines provide the necessary material.

In arranging original designs, symmetry and rhythm are essential, and a sense of fun helps. Each of the accompanying drawings it will be noted, suggests a decorative pattern apart from the figures portrayed. For practice purposes, the Egyptian design, in which two men are urging a stubborn donkey is an excellent one.

When the drawing is on wood the background may be cut away about $\frac{1}{4}$ in. deep. The vertical cuts can be made by using the palm of one's hand as a mallet, as shown in the upper left-hand photograph on page 74. For the horizontal cuts, hold the gouge or chisel with both hands as illustrated in the center and right-hand photographs of the same group. This gives one very accurate control of the tool and reduces to the minimum any danger that the tool will slip.

Miss Carol Coward is a wood carver of international fame. The seated figure of Christ, shown above which is 4 ft. 6 in. high, is a fine example of her work. She believes any home worker can get great fun out of wood carving if he first confines his endeavors to simple, geometric panels. This one is a copy of a museum piece, even to the cracks.

One other suggestion. It is often possible to improve the background by punching it irregularly with a large well-blunted nail, a flat punch, or regular wood carving punches.

Egyptian work being elementary in character, we may pro-



Miss Carol Coward is a wood carver of international fame. The seated figure of Christ, shown above which is 4 ft. 6 in. high, is a fine example of her work.

She believes any home worker can get great fun out of wood carving if he first confines his endeavors to simple, geometric panels. This one is a copy of a museum piece, even to the cracks.



ceed as follows. Leave in high relief the limbs of the figures and the donkey that are on the near side, but cut back considerably those on the remote side. The figures are next rounded over at the edges everywhere and slightly shaped. Any lines such as the donkey's mane and saddle or the men's hair and eyes can be carved with the veneer. The extent of the modeling depends on the worker, but a certain crudeness is extremely effective.

If a common wood has been used, it should now be given a priming coat of paint. When this is dry the picture may be painted in bright rich, primitive colors. Walnut or teak can be polished with beeswax or furniture wax.

An alternative method of making panels of this type is to cut out the figures and details with a fret saw from a 1 in. board about $\frac{1}{8}$ in. thick (preferably solid wood, not three-ply). These can then

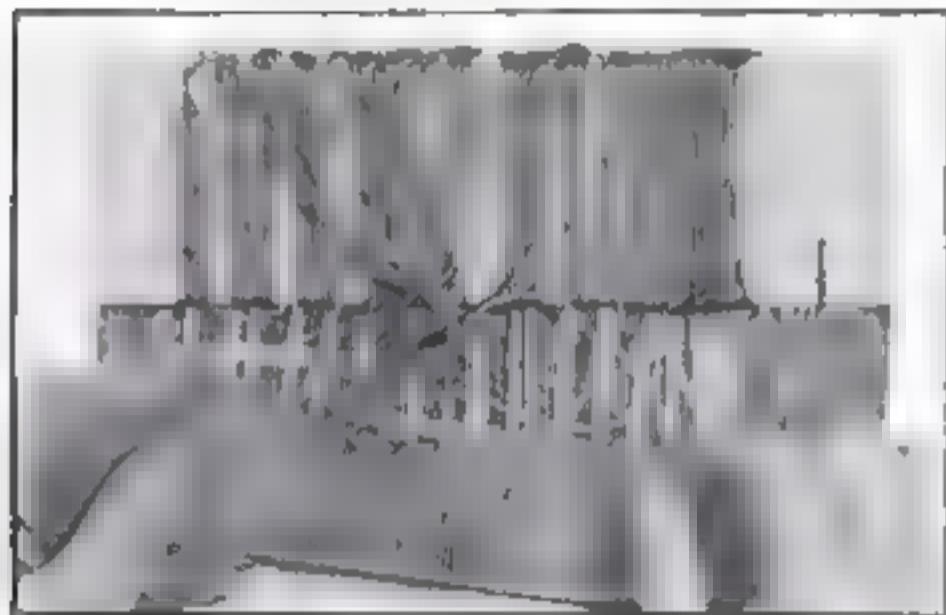
be applied to the planed surface of a panel, using glue and small nails or tacks. A few lines to indicate features may be carved with the veneer and the work finished according to the first method. This is almost equally effective, although it requires less skill.

For utilitarian purposes the panel may form part of a bracket, clock stand, pipe rack, or key-rack, but its happiest position is hanging on a wall.



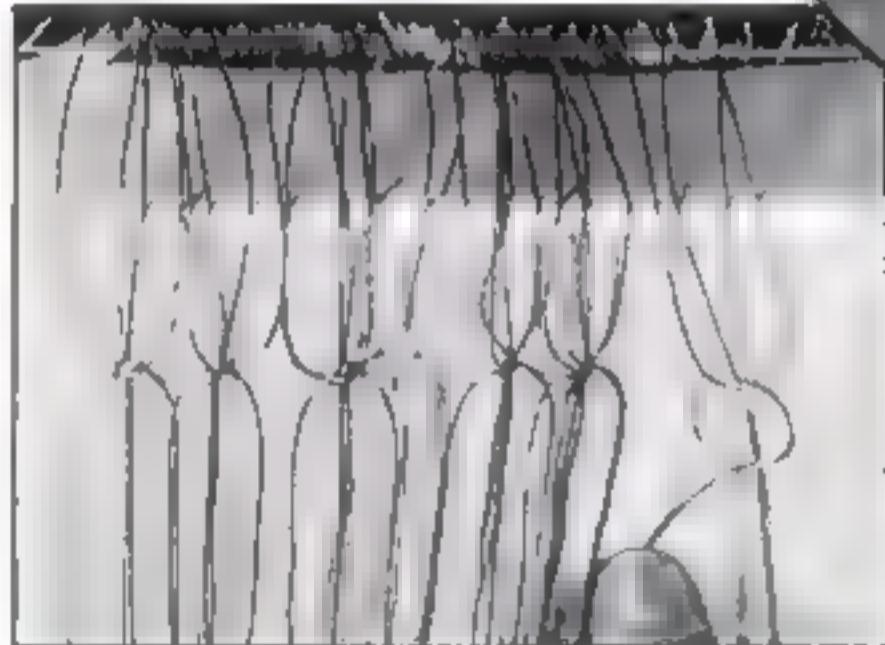
Two other suggestions. It is best to show the cracks and primitive irregularities and retain the crude draftsmanship of the originals.

Nimble fingers are all you need to make this SQUARE-KNOT TIE



Cords are arranged in the desired combination on by tying knots in the ends and then catching the ends in rows on a piece of cardboard. As shown at right, each knot is made by knotting two strands around two other strands. The knots are the common square knot.

By
KENNETH MURRAY



TWO balls of light silk cord, such as crochet silk, will make a good-looking square-knot tie. It has a distinctive, handmade appearance, is exceedingly durable, and will not wrinkle.

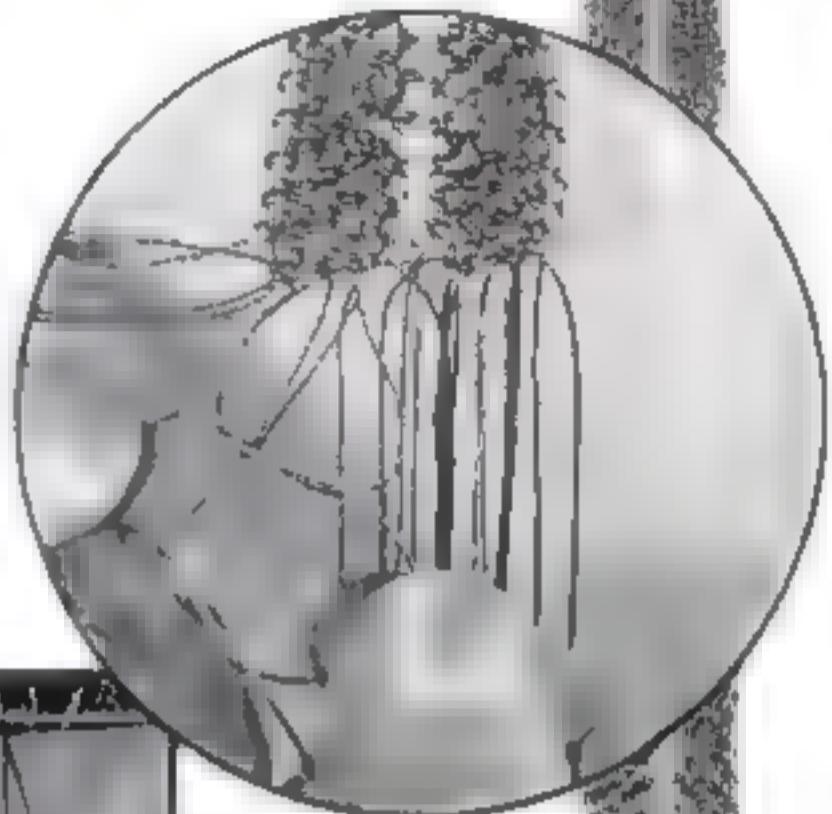
The simple two-color design illustrated is in good taste and not difficult for the beginner in square-knot work to follow. A satisfactory color combination is blue and light taupe. Cut twenty strands of blue and eight of taupe, each 12 ft. long. To keep them separated, knot and fasten the ends in knife-cuts made in one side of a strip of cardboard. They are grouped in the following order: two of taupe ten of blue, four of taupe, ten of blue, and two of taupe as shown in one of the photographs. Wind the strands on the card and place it under a weight at the edge of a table where the knotting is to be done.

Measure off 64 in., at which point the knotting is started. Commencing at the left, use four strands for each square knot. When the last four are reached, reverse the square knot by tying the last half hitch, to keep the design intact. Start the second row with the third, fourth, fifth, and sixth strands, reverse the fourth knot

but not the last. The third row is exactly the same as the first, the fourth like the second, and so on. Tie the knots tightly so as to make a piece about $\frac{1}{2}$ in. wide.

After doing about 2 in. of the knotting as just described, gradually make the knots farther apart to give an open-mesh effect, and widen the strip to about 1 $\frac{1}{2}$ in. This width is maintained until the tie measures 20 in. from the start, when it is brought to a point by the following method: Drop two strands at the sides of each new row of knots so that the knotting narrows to a point. Then bring the first or top strand at one side down toward the point and tie a double half hitch around it with the second strand, that is, the one next below it. Draw it up tight. Continue by half-hitching the remaining cords in order around the first cord to make a row extending to the point. Do the same with the other side, then half-hitch the first, or filler, cords together at the bottom. Make three complete rows of half hitches in this way, and trim the remaining cords short.

The work is now reversed and again knotted from the center. Make 10 in. of solid square knots, followed by 12 in. of



Knotting body of the tie above) and method of making the two rows of half hitches to finish pointed end (below).



open-mesh work, and finish in the same way as the other end with half hitches.

With some types of silk cord a little trouble may be experienced in making the first row of knots stay tight. Apply a minute quantity of white beeswax to the finger and thumb and rub it into a $\frac{1}{2}$ -in. space on each strand where the first knot is to be made. An ordinary pocket comb is useful in keeping the strands in order.

This is the third of a series of articles on square-knot work (see *P.S.M.*, Nov. '32, p. 77, and Mar '33, p. 68).

Nontipping ASH TRAYS



ONCE you have mastered the method of spinning the ash tray described in this article, you will be able to make a variety of useful and decorative objects from sheet metal with great rapidity and at very little expense. To do this you need no other machine but your lathe and a few homemade tools and accessories. These were described in the first article of this series (P.S.M., Mar. '33, p. 64).

The ash tray was designed by Frank J. Stoltzka, of Akron, Ohio, who has been spinning things from metal for more than forty years. It is a nontipping tray and its bottom is designed so that it will not scratch a table or desk top. The material can be copper, aluminum, or brass. The tray shown was made from 16-oz. sheet copper.

First obtain a steel disk about 1 x in. thick and 5 in. in diameter. Drill a hole in the center and thread it to screw on the spinning lathe spindle or intermediate chuck screw. Then turn the disk into the form shown in the drawing. Note that the sides taper slightly, with the outer diameter the smaller. Smooth the form with fine emery paper and fasten it to the spinning lathe spindle. If you have no metal turning lathe you can use a wood form, turning it to shape on the lathe to be used for spinning.

Cut a copper disk 7 in. in diameter. Then make a back-center adapter from maple or birch wood. This adapter should have a diameter almost as great as that of the turned form, as shown in Fig. 3. It acts as a go-between for the disk and the rotating back center. Later in the process the large adapter is replaced by a small metal button (Fig. 4).

Spinning metal is one of the most fascinating branches of craft work, yet amateur mechanics usually know very little about it.



No matter what the shape of the finished article the blank to be spun is invariably a disk. Professional spinners use a machine for cutting disks, but the amateur can do the work with metal snips.

2 The ash-tray form is attached to the intermediate chuck of the spinning lathe as shown at the left. One of the drawings on the facing page shows the shape in which the form is turned.

boring and threading the wood to fit the lathe or intermediate spindle, and then making a small metal button with a threaded lug that screws into the threaded hole as shown in one of the drawings. The projecting part of this button is square or hexagon shaped so that a wrench can be used on it, and there is a depression in the outer surface in which the back center will fit.

To return to the ash-tray. Place the disk against the chuck, and the adapter against the disk, and clamp them all together with the back center. Center the disk as accurately as possible by hand. Further centering can be accomplished by starting the lathe, loosening the tail stock



3 Turning the edge of the blank over the form to make the sides of the ash tray. Note the large wooden adapter block, and the back stock which supports the metal being spun.



4 In the next operation the large wooden adapter is replaced by a small metal button, and the concave ash receptacle is made by spinning the metal down into the form.

Spun Like Magic

FROM SHEET METAL

By Herbert Woolsey



3 The partly formed tray is next placed in a wooden chuck that is a block which is recessed turned to take up the tray snugly but with the edge protruding so that it can be turned with a lathe tool set in a handle.



6 After the rim has been trimmed with the lathe tool until only about $\frac{1}{4}$ in. projects from the chuck, it is turned inward with a blunt-nosed tool so that there will be no sharp edges to leave scratches on furniture.

spindle a little, and holding the broom-stick "back stick" against the disk edge.

Ordinary lard is a good lubricant for reducing friction between tool and work, or cup grease can be used.

Adjust the T-rest to the proper height and insert the pin so that the tool, when resting against the headstock side of the pin, just touches the work. Hold the end of the tool handle under your right arm and apply pressure against the spinning copper disk by pushing the tool handle to the right. You will be surprised at the ease with which the metal changes shape. While you are drawing the tool point from the center towards the edge, hold the back stick opposite it, on the other side of the disk. This prevents buckling and chattering. When the copper has been spun down against the form, stop the lathe and remove the large wooden adapter, replacing it with a small metal or wood button that is about 1 in. in diameter. Then start the lathe and spin the concave ring (ash receptacle) around the tray.

You are through with the first form as far as this job goes. There remains the task of turning in the lower $\frac{1}{4}$ in. of the side to form a rim that will stiffen the tray and prevent scratching table tops. To do this, you must make another chuck of wood. Attach to the spindle a disk of hardwood about 2 in. thick. Such disks are preferably made by gluing up two or three thinner sections, reinforcing them with dowel pins. In the center of the disk turn a cavity; this should conform in shape to the outside of the ash tray and be about $\frac{1}{8}$ in. deep.

The tray, when placed in this cavity, is held firmly by the back center and a small adapter button, with about $\frac{1}{4}$ in. of metal protruding. Use a sharp tool to turn the projection down to $\frac{1}{8}$ in. Now

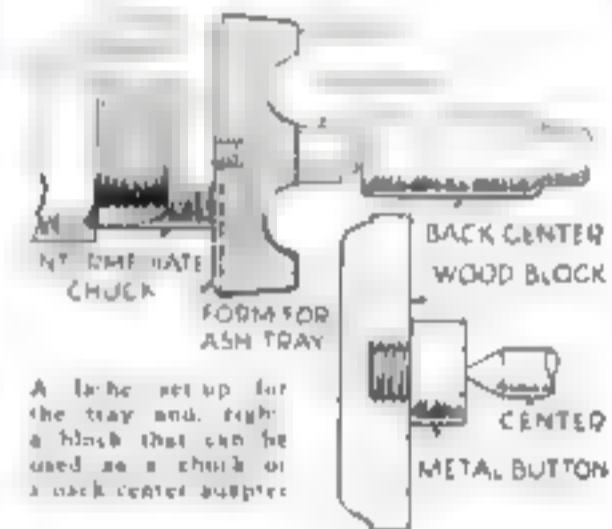
with a blunt-nosed tool apply pressure to the projecting edge until it turns over and inward.

In spinning the ash tray, do not be surprised if the metal cracks or otherwise becomes damaged during the first or even the second attempt. You may find it desirable to anneal the copper before turning over the edge.

There are various finishes you can apply to the copper tray. You can hammer the center and rim with a ball peen hammer, darken the hammered portions with strong



finished tray. The tray is 10 in. in diameter and $\frac{1}{2}$ in. deep.



A lathe set up for the tray and, right, a block that can be used as a chuck or a back center support.

A simple dark-room method of making “Charcoal” Portraits WITH YOUR CAMERA



HERE is a new idea for making extra money with your camera. Take portraits of your friends or their children, and finish them to look like large charcoal drawings.

The “sketch” at the head of this column, for example, was made by a simple dark-room process from an ordinary negative like the one of the baby shown in Fig. 1. The only extra materials needed (provided you have some kind of an enlarger) will be a box of “process” dry plates. One of the smaller sizes will do ($3\frac{1}{4}$ by $4\frac{1}{4}$ or 4 by 5), since the final “drawing” must be made by enlargement anyway.

This kind of plate is so much less sensitive than ordinary plates or films that it can be handled safely in the orange safe light used for developing bromide paper enlargements. “Process” plates (as the name indicates) are used in the engraving processes and give maximum contrast.

The portrait negative you select should have well-marked but not violent contrasts and gradations. When you have picked it out, arrange your dark room so that a white frosted bulb of 40 or 50 watts can be turned on and off easily. Have ready a tray filled with plain water, one with acid hypo, and one with ordinary M. Q. tube developer. Be sure to mix the latter with the amount of water required for developing plates and films.

Then, with the room lighted only by the No. 0 (orange) safe light, place one of the process plates (film side down) in a printing frame behind the negative you have selected. You can tell the film side

By
Frederick D.
Ryder, Jr.

Although it resembles a costly free-hand charcoal portrait, the baby's head at the left was made from a photograph similar to the one shown below.

without difficulty by noting the dull reflection it gives at the orange safe light.

Now stand the printing frame facing the 40- or 50-watt bulb and about 10 in. from it. Switch the light on and off quite rapidly. For the average negative the exposure will be about a second or less. Then remove the exposed “process” plate and develop it like an ordinary one, but carry the development quite far. The positive print that results will have considerably sharper contrasts than the original photo (Fig. 2).

After fixing is complete, two or three minutes' washing will be sufficient, as this glass positive is for temporary use only. Dry it, hurrying the process with an alcohol bath and an electric fan if you have one handy.

Next place this positive in the printing frame just as you would a negative, back it with another process plate, and repeat the previous printing procedure. The result this time will be a negative as shown in Fig. 3.

When this new negative is dry, turn it back into a positive by printing it upon another “process” plate (Fig. 4). The picture has now been simplified into very nearly the black and white effect we desire. Place this fine contrast positive in the enlarger and project the image of the head upon still another process plate. After focusing carefully, stop the enlarging lens down and give a short exposure. This will, of course, depend upon the technique detailed on page 97.



2 From the negative a positive print is made not on paper but on a so-called process plate, which will give the maximum contrast.

3 Unless sufficient contrast has been developed in the first positive, it is now necessary to make a second negative. Here again a process plate is used.



1 The starting point is an ordinary negative such as anyone can take. It should have well-marked but not violent contrasts.



4 From this negative another positive is made. This is set in an enlarger and the image of the head alone is projected upon another plate. The latter is the negative used for making the final enlargement.

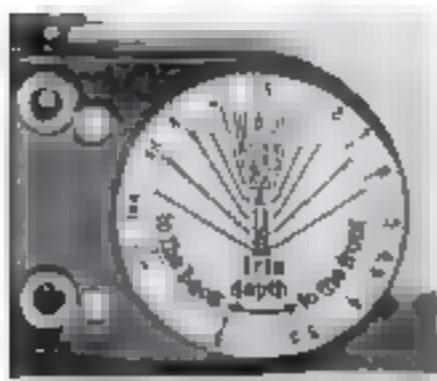
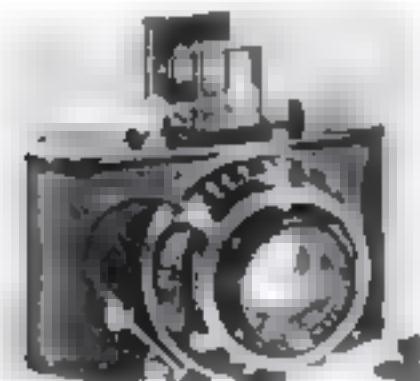


EASTMAN NEWS BULLETIN FOR THE AMATEUR PHOTOGRAPHER

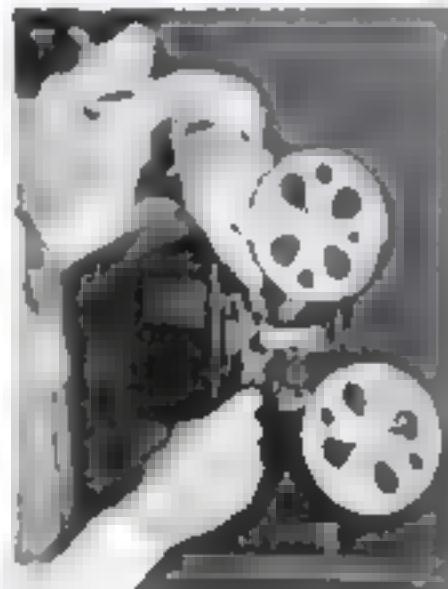
APRIL, 1933, PUBLISHED BY EASTMAN KODAK COMPANY



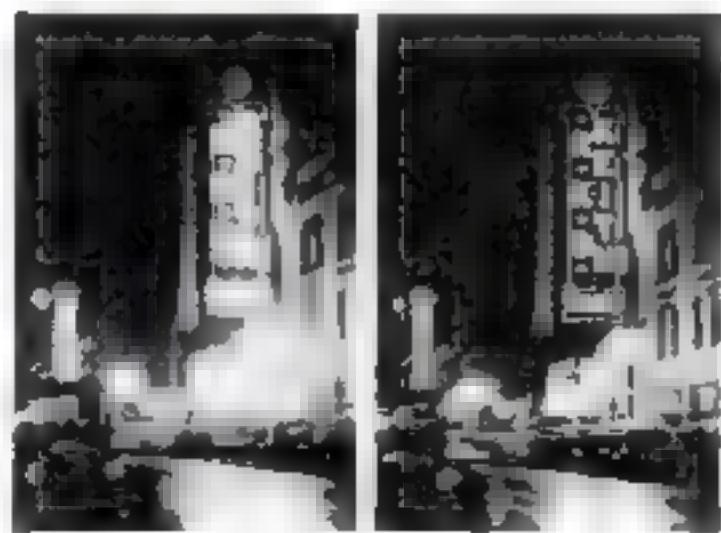
Kodascope Eight projects the movies you make with the Ciné-Kodak Eight and the film shown above. Note the small size of the reels—only 9 inches in diameter—which run for more than 10 minutes. Easy threading, brilliant projection, and rapid rewinding are features of the Kodascope Eight. Model 45, illustrated \$34.50. Other Kodascope Eight Models, \$24.50 and \$25. Write for booklet.



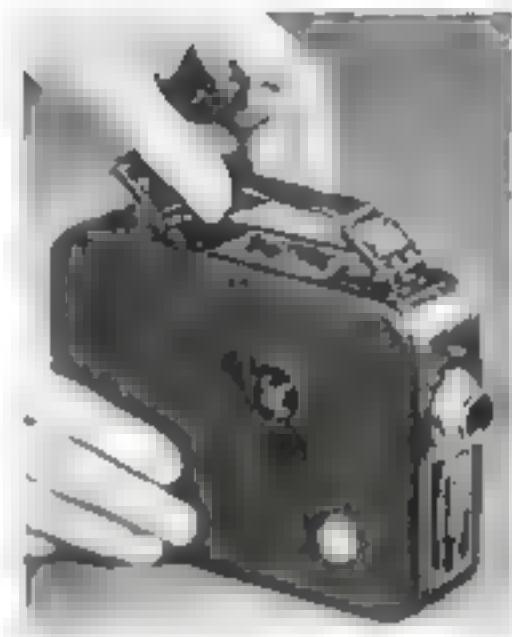
WHAT A DIFFERENCE FILM MAKES! Note the absence of halation in the picture at the far right made on Kodak Verichrome Film. The difference between this picture and the one at its left, made on ordinary film, is due to the special non-halation backing on Verichrome. Exceptional freedom from halation is also noticeable in the highlights of Verichrome pictures made in the daytime, especially in bright sunlight.



MINIATURE MASTER OF LIGHT AND SPEED. Kodak Pupille (left) makes sixteen exceptionally sharp negatives, capable of great enlargement on a roll of Kodak No. 1ay Vest Pocket Film. The Pupille's lens is the ultra-fast Schneider Xenon f/2 Anastigmat. Its shutter is an 8-speed Compur. A revolving scale (lower illustration) indicates the depth of focus at any distance with various lens openings. Price of Kodak Pupille, with case, range finder, and a color filter, \$75.

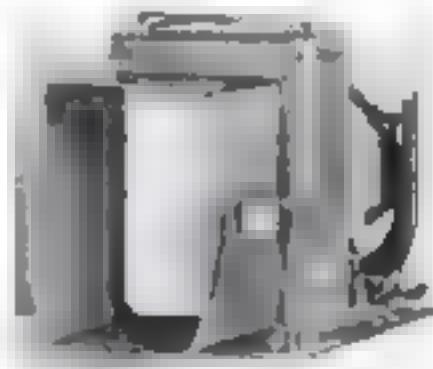
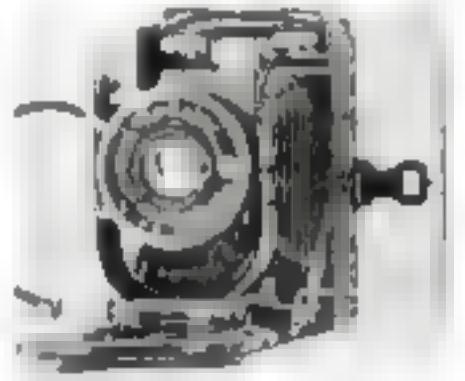


A 4-MINUTE MOVIE IN THE HOLLOW OF YOUR HAND. Photograph at left shows the small size of the 16-foot Ciné-Kodak Eight movie film roll, equal in running time to 100 feet of usual amateur movie film. Costing only \$2.25, this small film will take 20 or 30 scenes averaging as long as those you see in standard theater productions, at a cost of less than 10 cents a shot. Eastman's new principle movie camera—Ciné-Kodak Eight—makes this film economy possible. The film is run through the camera twice, pictures being taken on but half the width of the film each time. The 16-foot 16 mm. film is then processed by Eastman, without further cost, and returned to you as a 80-foot 8 mm. film ready to project.

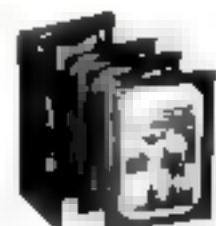


FINDERS INTEGRAL WITH HANDLE. Flip up the handle, the finders automatically jump into place. One of the many ingenious features you'll find only on Ciné-Kodak Eight, above. With this \$29.50 camera and its low-cost film you can make excellent movies at less expense than ever before.

WIRE-FRAME DIRECT VIEW Finders like that shown no cameras at all are used by all news cameramen for spotting and framing their subjects quickly yet accurately. There's one on each of the Kodak Recorders 16 and 35, in addition to a brilliant reflecting finder. Price of the Recorder 16 (16 x 3.3 x 1.66); Recorder 35 (4 x 3.3 x .64).



A GROUND GLASS SCREEN with collapsible hood (at left) adapts the Recorder to the needs of the pictorialist, interested in getting just the right composition and degree of definition for the most pleasing effect. The Recorders are equipped to use film packs, plates, or cut film, available in a wide range of color sensitivity and speed.



KEEPS PRINTS CLEAN, QUICKLY ACCESSIBLE. Small, light weight Simplex Pocket Photo Case fits your coat pocket comfortably. 25-print capacity. Price, 25 in 35 cents.

INFORMATION REQUEST

P. S. 4-20

Eastman Kodak Company, Rochester, N. Y. Please send me literature regarding items mentioned in your April Bulletin, as checked below.

Ciné-Kodak Eight Kodak Recorder
 Kodascope Eight Kodak Pupille

Name _____
Street _____
City _____ State _____



A useful spot-welder for any shop where sheet metal is fabricated. Metal up to No. 16 gage may be welded.

ABOUT any shop in which sheet metal is fabricated will profit by having an electric spot-welder. A machine like the one illustrated above will handle materials up to No. 16 gage quite readily.

The parts are all mounted on a piece of dry, well-seasoned 2 by 12 in. wood

wish enough No. 2 double cotton covered wire wire to give about 13 volts on each transformer. Then they were connected in parallel, and their leads brought out to the upper and lower members of the welder.

The electrodes were made by pointing

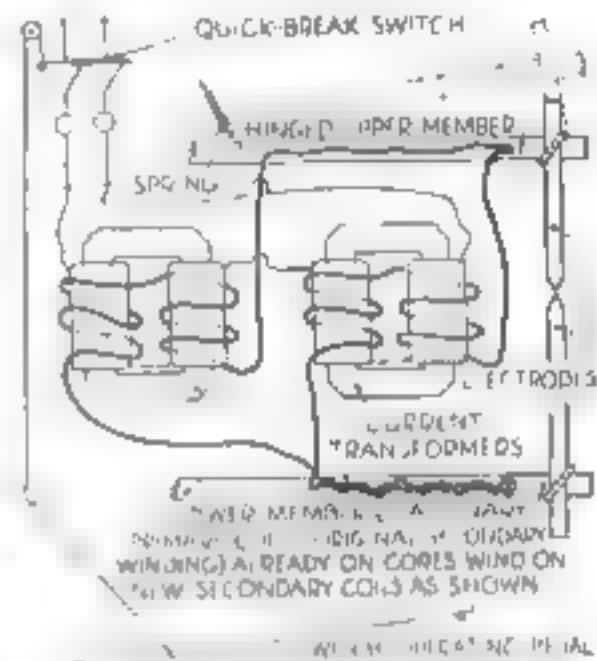
LOW-COST ELECTRIC SPOT-WELDER BUILT WITH OLD TRANSFORMERS

about 5 ft. long. Of course, a low-voltage, high-current transformer may be bought or built up; but time, labor, and expense may be saved by going to the local power company and getting discarded or obsolete current transformers. These companies are usually generous in such material.

For this particular welder two 1,500 to 5 amps., 2,300 watts, type F. B. current transformers of standard make were used. These were of the so-called "through type," that is, a single turn of main bus or cable is put through the core as the primary. Their secondary windings were hooked in series and used as the primary winding of the welder on 220 volts. For 110 volts it would be necessary to hook the transformers in parallel. The primary was run through a 30-ampere enclosed quick-break switch.

1/4 in. square copper bars at one end. The lower member was fastened rigidly to the backboard, but the upper was hinged and supported by springs, which normally hold the two electrodes apart. Both the electrodes and their supports were tinned.

In use, the electrodes are pressed firmly against either side of material to be welded, and then the foot pedal is pushed down, thereby throwing in the switch and energizing the primary—BENNETT TAYLOR.



Hook up for 220 volts A. C. For 110 volts the transformers are connected in parallel.

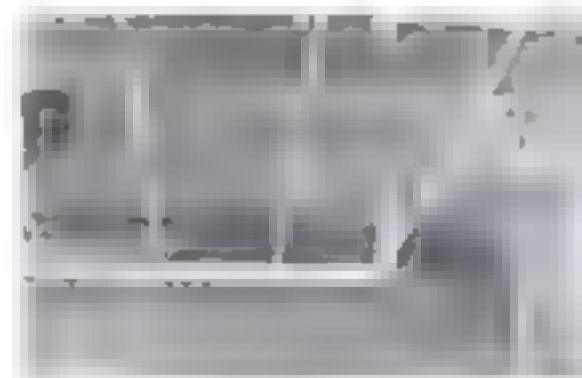
RIGGING CLOTHESLINE IN BASEMENT

ANYONE who has had the misfortune to run into a clothesline strung up in the basement will appreciate the method of arranging a line shown in the accompanying illustrations. When not in use, the line is raised out of the way.

At each end of the line are two hangers and one crossbar made from 1 by 2 in. wooden strips. The crossbars should not be much longer than 5 or 6 ft. nor should more than four or five lengths of lines be strung between them unless heavier material is used. The hangers are fastened directly to the crossbar with 2 by 3/8 in. bolts. The top ends of the hangers are



When the indoor clothesline is not in use, the crossbars are pushed up out of the way.



Looking toward one support of the clothesline, which has been lowered, ready for use.

fastened to the floor joists overhead by means of 2 in. No. 10 wood screws. The bolts and screws should be tightened just enough so that when the wooden members are raised to the ceiling they will stay in place. A short loop of line tied to the crossbar at each end makes it easier to pull down the hangers.

The lines are strung through 3/8-in. holes bored along the center line of the crossbar about 1 ft. apart. These holes are slightly countersunk.—WILLIAM T. WELD.



TWO HINTS ON SETTING A SURFACE GAGE

THE two surface gage banks shown in the photograph above may not always be necessary at the same time, but they are shown together to save space. A small magnet is laid on top of a parallel or similar object to hold the scale upright for conveniently setting the surface gage, and a piece of white paper or cardboard is slipped on the scriber to reflect the light on the scale when the electric bulb is fixed overhead or the bench faces a window so that the scale graduations do not show up plainly.—H. MOORE.



This photo of a small sample piece of tin shows what a Wolffman-like effect may be obtained by the simple expedient of using a common pencil eraser to spot in rows of highly polished circles.

PENCIL ERASER POLISHES TIN

ORDINARY sheet tin, when used for models, can be given a finely finished appearance with the aid of a lead pencil having an eraser that has never been used. Hold the pencil vertically and revolve it once only, using one hand to act as a bearing to keep the eraser in position on the metal. In this way form a series of circles arranged in straight lines without overlapping. After the area is thus neatly spotted with highly polished circles, give it a coat of clear lacquer to protect the finish.—DONALD R. FULTON.

WHEN THE "BABE" WAS AS COOL AS AN INGRAM'S SHAVE



PRESS BOX STORY BY
Bill Corum
Sports Columnist N. Y. Journal



In my business a fellow has to keep cool.

The customers may tear away the hats and pound the little woman between the shoulder blades when a challenger has too champion hanging on the ropes, but a sports writer must remember where he hit him—and with what!

So I prepare by using Ingram's Shaving Cream. You can't be hot and bothered—you don't miss the close ones—when your face is cool and comfortable. Coolness, that's the Ingram prescription—a coolness like the Babe's when the going is rough. And there's a story.

Series, Ruth at the plate. Two strikes on him and the Chicago fans and the Chicago bench rising high for all they are worth.

And the Bamboozle? He tosses a big grin to the Chicago dugout and the cash embezzlers. He holds up two fingers to show he knows all about those two strikes. And then he points to the spot in center field to show where the ball is going—and never coming back!

Up comes the ball. "Hello, you old potato," greets Babe and smacks the longest home run to center field ever seen at Wrigley Field.

It was like a golfer standing on a 300-yard hole and telling 50,000 persons he was going to cup the pellet in one—then doing it.

Coolness—that's what I like about the Babe. And that's what

The scene—Wrigley Field, Chicago. The time—the last game of the 1932 World Series. Ruth at the plate. Two strikes on him and the Chicago fans and the Chicago bench rising high for all they are worth.

I like about Ingram's Shaving Cream, I've been using Ingram's for years and my beard is no pushover. With me it's once over and away in time for Boots and Saddles or the first round bell.

I like the tube better because it's handier out long jumps—but tube or jar, Ingram's is one thing I can take on the chin and come up smiling. Believe me—Bill Corum.

With Ingram's Shaving Cream it's back to the bench with stingsless shaves. Every blue and white jar—every tube—contains three special ingredients that guarantee a "No rashes, no burns, no letups" performance. If you want to find out why—send us the coupon and a 3¢ stamp and we'll send you ten cool shaves free. You'll like 'em and you'll be back for more.



INGRAM'S



SHAVING CREAM

Broadway-Murray Co., Dept. H-43
110 Washington St., New York, N. Y.
I'd like to try ten cool Ingram shaves.
I enclose a 3-cent stamp.

Name _____

Street _____

City _____

State _____



CONSTRUCTION *Saves you MONEY*

A tire that has two plies of fabric and an extra breaker strip under the tread is not a 3-ply tire. But a U. S. Giant Chain has three plies of the strongest bicycle fabric made all the way around. Such super-construction makes it a better tire—built to defy cracking, bruises and bowouts—built to save you money and give you longer trouble-free service.

Get all four of these features in the bike tire you buy . . .

- 1 Construction**, three strong plies all the way around—not just 2 plies and a breaker strip—deep, buttressed tread of toughest rubber known.
- 2 Rim Grip**, flannel strip makes possible grip that prevents creeping, eliminates separation of tire from rim. On all U. S. tires.
- 3 Non-skid Tread**, specially designed to give greater non-skid safety on terrain riding conditions.
- 4 Appearance**, sidewalls are permanently white, tread permanently black—tire always new-looking.

And because these features are built into every U. S. Giant Chain Tire, you do get longer trouble-free service—and naturally more for your money.

United States Rubber Company
WORLD'S LARGEST MANUFACTURER OF RUBBER



MANUFACTURERS OF RUBBER

ALL U. S. TIRES AL-
WAYS HAVE THIS SEAL

Makers of the U. S. Peerless, Nonpareil, Overland and Juvenile—tires for any bike or any circumstance.



U.S. Giant Chains
with the GRIP that never slips

Electroplating with ZINC-CADMIUM

A new, simple process for coating iron with a durable, bright looking, rustproof alloy

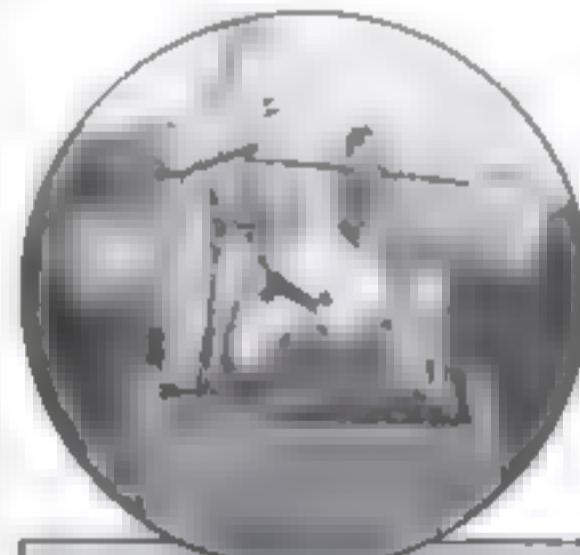
By
ISADORE
KOWARSKY

A NEW method of electroplating iron with zinc-cadmium alloys now makes it possible for anyone to obtain excellent plating results without the use of expensive apparatus and equipment. The deposits obtained are not only durable, uniform and brilliant, but they provide the best possible protection from corrosion.

This method was developed in the chemical laboratory of Washington University, St. Louis, Mo., after tests had shown that certain alloys of high zinc and low cadmium content were almost as good as pure cadmium for rustproofing purposes. It was found to give excellent results on iron under the most difficult

conditions, requiring little or no control or sharing of current behavior. It is unusual for plating solutions and a great advantage to the amateur who has never plated before but wishes to obtain as good results as the professional plater.

For most work the hard rubber case of an automobile storage battery will serve as a tank after the two cell partitions have been removed. Such a tank will require from 1 to 1½ gallons of solution. If no



In circle: An end wrench ready for plating. It hangs from the middle tube while the anodes or positive electrodes are fastened to the end tubes. The other photo shows plated articles.

This method of plating has the following advantages:
1. It is simple.
2. It is inexpensive.
3. It is rapid.
4. It is safe.
5. It is reliable.

the purpose. Lay two tubes across the ends of the tank and a third across the middle as shown in the diagram below. Then connect the two end tubes to the positive pole of a 6-volt storage battery and the middle tube to the negative pole in series with the latter, or negative one, insert a rheostat. The latter can be improvised from a nichrome wire heating unit and a battery clip, the resistance being varied by sliding the battery clip along the length of the wire. If you have an ammeter, connect it in series with the nichrome wire. These connections are indicated in the diagram. When no ammeter is at hand, the connections are the same except that the rheostat is connected directly to the middle supporting tube.

For the anodes (the positive electrodes), use either zinc, cadmium, a hard

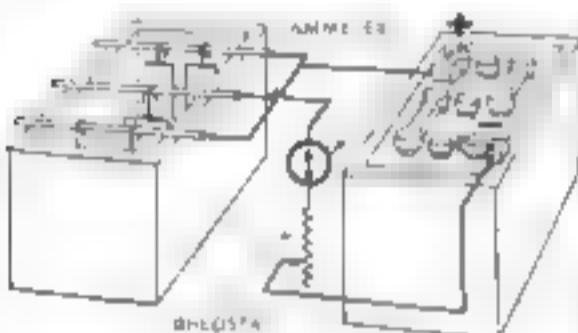


Diagram for placing. A nichrome heating unit may be used instead of the rheostat.

and have them made of the two lead or high silicon steel (duron). Of these, the mixture of cadmium and zinc will give the best results in the long run. If lead or duron is used, it must be remembered that poisonous hydrocyanic acid gas is given off in cyanide solutions; therefore runs of over ten minutes should not be made within doors.

Whatever metal is used for the anodes if it is in sheet form cut it up into strips about 1 in. wide. Cadmium is usually bought in sticks. To the end of each strip or stick solder a 3-in. length of No. 18 gauge copper wire; then hang these from the anode supports (the two end tubes) by bending the wire over the tubes. Always be sure that no part of the copper wire will be immersed in the solution.

Having the tank and its accessories prepared, you next make up the solution. The following chemicals will prove sufficient to make 1 gal.: 35 oz. cadmium oxide, 1 oz. zinc cyanide, 10 oz. sodium cyanide, 1 oz. sodium hydroxide, and water (tap water may be used) enough to make 1 gal. Cyanides are poisonous and should not be allowed to come in contact with the mouth or open cuts. If any of the solution gets on the hands, wash it off immediately. Ordinary precautions, however, reduce the danger of handling cyanides to such a point that many tons of cyanides are used daily in industries without an accident.

Dissolve the sodium hydroxide and sodium cyanide in 2 qt. boiling water. To the other ingredients add enough water to make a thin, uniform paste, and add this while stirring to the hot cyanide solution. The cadmium oxide will probably require several hours for complete solution, so stir the solution occasionally until all has dissolved. Then add the remaining water and the (Continued on page 85)

Free Booklet Reveals Vital Facts about ULTRA-VIOLET

GET THIS BOOK AND FIND OUT

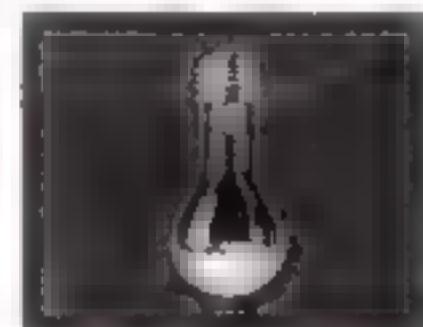
- How you can have indoor Sunlight all year round.
- Why Ultra-Violet rays are beneficial.
- How Ultra-Violet rays aid building of bones and teeth.
- Why we need Sunlight the year round.
- Why winter Sunshine is weak in Ultra-Violet.
- How civilization is cheating us of our rightful share of Sunlight.

WHAT are these mysterious, invisible rays in sunlight that have so much to do with our well-being? Why do we instinctively seek the sun? Why is it that sunlight plays such a vital part in building strong bones and teeth?

All these questions and more are answered in this new 20-page illustrated booklet. Get your copy. Learn the important facts about sunlight. Learn how clouds and smoke and weak winter sunlight deprive us of these vital rays.

Read all about the new "Indoor Sun"—the MAZDA Sunlight Lamp that looks almost like an ordinary light bulb, but does so much more! See pictures of new low-priced fixtures made specially for use with the MAZDA Sunlight Lamp by eight leading manufacturers.

Think of it—light in your own home—



This MAZDA Sunlight Lamp (Type S-2) at a distance of 21 inches gives 5000 lux (ultra-violet equivalent of full-day midsummer sunlight).

Approved by the Council
on Physical Therapy of the
American Medical Association



warm, bright sunlight. Not just in the summer, but 12 months a year. Not just in the daytime, but Day and Night. No trouble. No inconvenience. No clumsy equipment. No goggles to wear. You switch it on or off just as you do a reading lamp.

Children love this warm bright indoor sunlight. Grown-ups relax in its rays. Little bones and teeth receive the aid they need all year round. Men and women, old, young, rich, poor, can have the sunlight they crave every day—winter or summer.

The illustrated 20-page book, pictured above, tells all about the new Indoor Sun—what it does—how it works—and how little it costs. Send for your copy of this Free Book today. It will reach you by return mail. Mail the coupon NOW.

GENERAL ELECTRIC

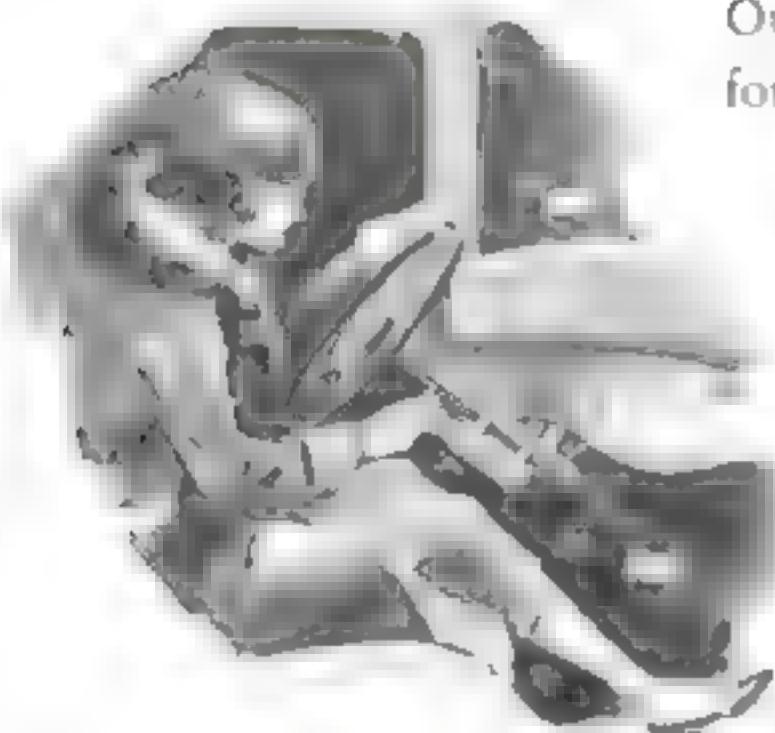
GENERAL ELECTRIC, Nela Park, Cleveland, Ohio

Please mail me, without cost or obligation, the free illustrated book, "The Indoor Sun." Also a list of the manufacturers who make the fixtures for use with the G-E MAZDA Sunlight Lamp.

Name _____

Address _____

Ingenious Ideas for Motorists



Holder made of radiator connection hose is attached to steering column and keeps your flashlight always handy

Is a holder that attaches to the steering column of your car, you can keep your flashlight within easy reach. The inexpensive holder illustrated is made from an 8 in. length of $1\frac{1}{2}$ in. radiator connection hose by plugging the lower end with a cork or suitable wood disk. The plug is held in place with glue and brads driven through the rubber fabric of the hose. Being soft, this holder will protect the flashlight from damage and there will be no metal to rattle. Two ordinary hose clamps are used to fasten the holder in place. If desired, the attachment can be enameled.—W. A. J. H.

Substitute Valve Spring

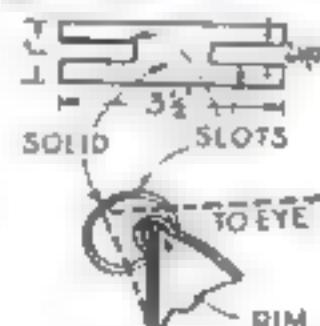
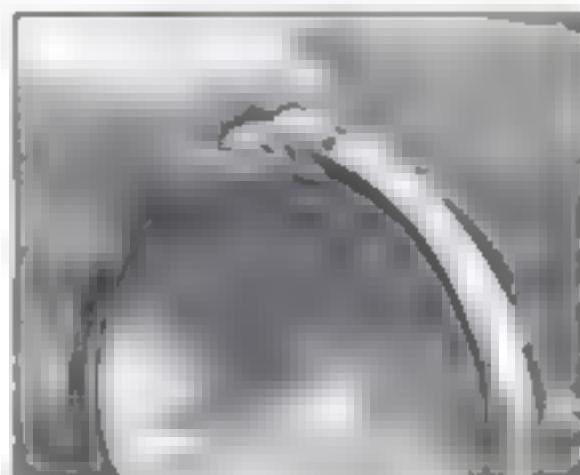
When a valve spring on your overhead engine breaks, you can make an emergency repair that will get you to a service station in time by using the simple arrangement shown. A piece of wire is made into a sling and looped under the washer on the valve stem. Then, several strong rubber bands are fastened to the upper end of the wire and wired to a stout stick placed across the radiator brace rods.—E. C. W.

When Lamp Burns Out

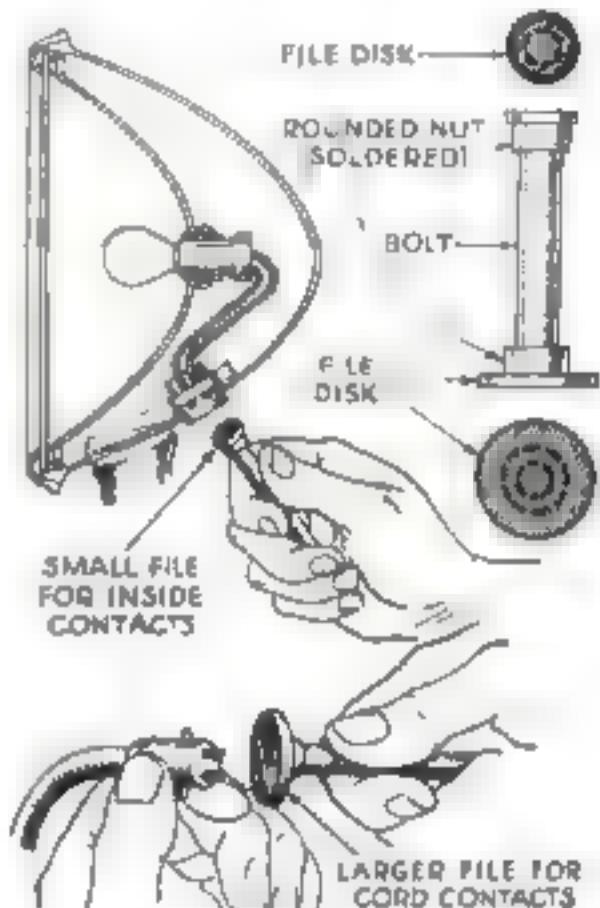
STRIPS of tin, bent to fit on the rim of each headlight serve as inexpensive indicators to warn the driver if one of his lamps burn out. Through the middle of a piece of tin, 1 in. wide and $3\frac{1}{2}$ in. long,

Our Readers Give You Many Suggestions for Adding Conveniences to Your Car

cut two $\frac{3}{8}$ in. slots as indicated. This will form a center section about $\frac{1}{2}$ in. long. Then bend the tin so that it fits snugly over the headlight rim at the top. When the strip is properly adjusted, it will catch a part of the headlight beam and reflect it back to the driver as a telltale. To improve the indicator, polish the inside surface of the tin with sandpaper or mineral wool. Of course, one indicator should be installed on each head lamp. Similar indicators made about half the size shown, also can be fitted to the small fender lights or cowl lamps for city driving.—L. M.



A strip of tin bent to fit over rim at top of head light will reflect beam of light and show if bulb is burned out. A diagram showing how tin is bent and attached to lamp rim



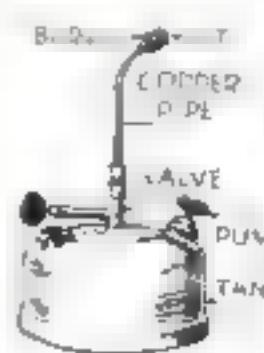
Small Cleaning Tool

A tool for cleaning the contacts on headlights can be made from two disks cut from a discarded file and a $1\frac{1}{2}$ in. bolt and nut. The nut is first soldered permanently in place on the end of the bolt and then, as shown in the drawing, the bolt head and nut are rounded and the two file disks soldered in place. The smaller disk, $1\frac{1}{2}$ in. in diameter, can be inserted in the headlight socket and rotated to clean the inside contacts. The larger disk $1\frac{1}{2}$ in. in diameter serves for cleaning the terminals on the lamp connection plug. The tool can be kept in the side pocket of your car.—E. D. T.

Pressure Oiler for Car's Springs

From the base and valve of an old gasoline lantern, the amateur mechanic can make a pressure oiler for springs. Filled with spring oil and pumped up to obtain pressure, the oiler takes the place of the old paint brush and pail of waste engine oil that many car owners use. A short length of copper pipe or tubing is first fitted with a burr or nut and the jet from a discarded carburetor screwed in. The pipe is then bent over as shown and fastened to the lantern base just above the valve. Being removable, the carburetor jet can be cleaned when necessary. In use, fill the tank with spring oil, operate the

small pump to obtain sufficient pressure, and open the valve. The oil is forced between the spring leaves and a good job is assured.—H. R.



ELECTROPLATING WITH ZINC-CADMIUM

(Continued from page 83)

solution will be ready for the plating tank. Objects to be plated are best cleaned as follows. First, remove any superficial rust or scale by rubbing with a kitchen cleanser, then immerse the work in a boiling alkaline solution for 10 minutes. This solution consists of 22 oz. of sodium carbonate (washing soda crystals) and 2 oz. of sodium hydroxide to 1 gal. of water. After removing the articles from this solution, wash them and immediately place them in the plating solution. Be sure not to touch them with the fingers because fingerprints will show up badly in the final plate.

In case an object is covered with rust that cannot be removed by the cleanser, immerse it in a dilute hydrochloric acid solution until the rust has been dissolved. Then continue as before.

WITH the aid of copper wire, suspend the work from the cathode (middle) support so that the entire surface to be plated is immersed in the bath. It is a good idea to prepare several pieces of heavy copper wire with a hook at each end. If there is a hole in the object, slip the hook at one end of a prepared wire through it and place the other hook over the cathode support. If the object has no convenient hole, you will have to suspend it with a battery clip or by means of a long wire twisted around it. In either case change the position of the point of contact several times during the plating operation so that the whole surface of the object will be covered.

Adjust your rheostat to its point of greatest resistance, or if you are using a heating unit wire, see that all the wire is in the circuit. A bright cadmium-zinc alloy will immediately begin to be deposited on the object. Until the deposit shows signs of becoming dull, you can increase the current by decreasing the resistance of the rheostat. When plating very small objects, it may be necessary to use only two, and sometimes only one, of the cells of the storage battery, in order to obtain a bright deposit. When plating very large articles, it is better to cut the rheostat out of the circuit and adjust the current by switching from one to two to three cells of the battery, whichever way a bright deposit is obtained. If you have an ammeter in the circuit, you will find that best results are obtained when the current density is 30 amperes per square foot (144 sq. in.) of surface. Remember, however, that the nichrome resistance wire will not carry more than 3 or 4 amperes without overheating, so if you require a greater current, make the adjustment by using different numbers of cells of the battery. If you have two storage batteries, you can obtain a greater current range by using them connected in series (the positive terminal of one being connected to the negative terminal of the other).

FIVE minutes at 30 amperes per square foot will give an excellent deposit. If you have no ammeter in the circuit, but the deposit is coming out bright, allow the current to pass for from five to ten minutes. The longer the current is allowed to pass, the thicker will be the deposit and the longer will the work be protected from corrosion. At the end of the run, turn off the current, remove the plated object from the solution, and wash in running water. Then dry it with a cloth. If the deposit was bright, it will take on a high polish when rubbed with a soft dry cloth. Otherwise, any metal polish will produce the same result. If you have a buffing machine, you can give the object a high polish that will approach that of modern chromium plated ware.



"CHET" MILLER'S THOUGHTS
WHILE SCALING PIKE'S PEAK IN RECORD TIME
• • IN A TERRAPLANE SIX • •

"They tell me Terraplaning - next to seaplaning - all right, baby, you've got to live up to that name - the gun - boy - feel those Champion Spark Plugs bite into that mixture - no wonder all these hellbenders around here use em - up we go - there's more driving in this 9000 foot climb than in 100 miles at Indianapolis - Champions have all the records there, so we've got to break this one - I'll throw her into this curve hard - what a murderous test of a car this is - here's that wicked switchback - bend yourself around this one - air a little then - guess those Champions would fire any time, though - not a sputter or a split second miss - we're almost there Terraplane - the top's in sight - fire away Champion - another wicked turn - the flag - we're over the top - with Champion plugs this car climbs like a mountain goat - what's my time? - What? - 21 minutes, 20.9 seconds - whoopee, a new all time stock car record for Hudson. And another record for Champion - here boy, take a wire to the Champion Spark Plug Company."

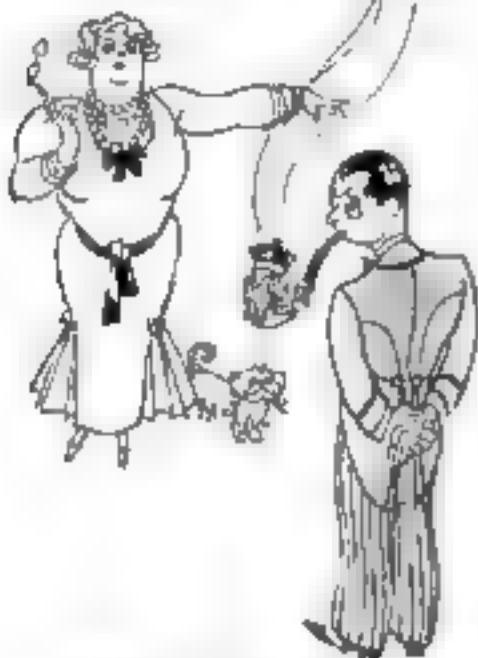


Mr. S. G. Balts, Chief Engineer of the Hudson Motor Car Company, says of Champion Spark Plugs: "We have selected Champion Spark Plugs for Hudson-Essen cars because of their outstanding record for better performance and dependability."

CHAMPION
EXTRA-RANGE
SPARK PLUGS

CHAMPION SPARK PLUG COMPANY, TOLEDO, OHIO; WINDSOR, ONTARIO

Heirloom or not— give it the Air!



WHEN she told him to throw that seeking relic in the rubbish can, he was offended. Scouting? Pooh! Not as scrupulous as grandma's nose. Let's be brutally outspoken. Why should a man keep on smoking a pipe through sentiment, when it's full of sediment?

When you smoke mild tobacco in a well-kept pipe, everybody's happy, yourself included! We never heard anything but compliments about the smoke Sir Walter Raleigh's mild Burley mixture makes when it curls merrily from the bowl of a well-behaved briar. It is smooth and fragrant, yet full-bodied, rich and satisfying; and it's kept fresh by gold foil. Its record of popularity alone makes it worth a trial next time you step into your tobacco store.

Brown & Williamson Tobacco Corporation
Louisville, Kentucky, Dept. Y

Send for this
FREE
BOOKLET

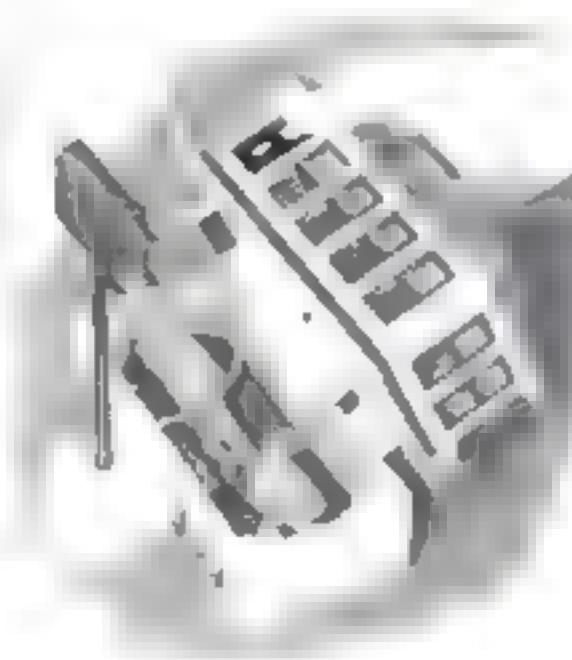


It's 15¢—AND IT'S MILD

Signal Towers for a Model Railway

MODEL railway enthusiasts who have built the full automatic block control as I'm described in this magazine some time ago (P.S.M., Dec. '30, p. 94, Jan. '31, p. 86, and Feb. '31, p. 128) or, in fact, who intend to install almost any type of signal system, will find this signal house satisfactory.

The method of construction is such that the solenoid switch operating the automatic block system is concealed in what appears to be a concrete foundation for the upper structure. The signal tower illustrated is made from $\frac{1}{4}$ in. thick wood, but one that is equally realistic can be constructed from cardboard.

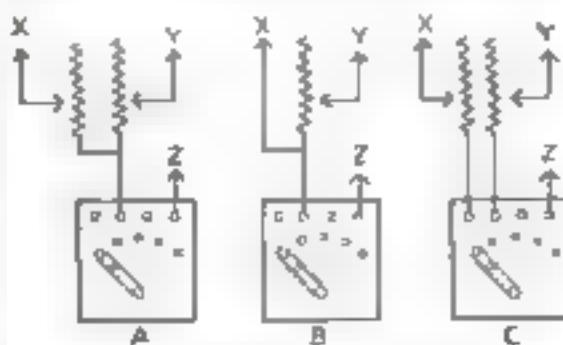


The top part may be lifted off when necessary to inspect the signal control mechanism.

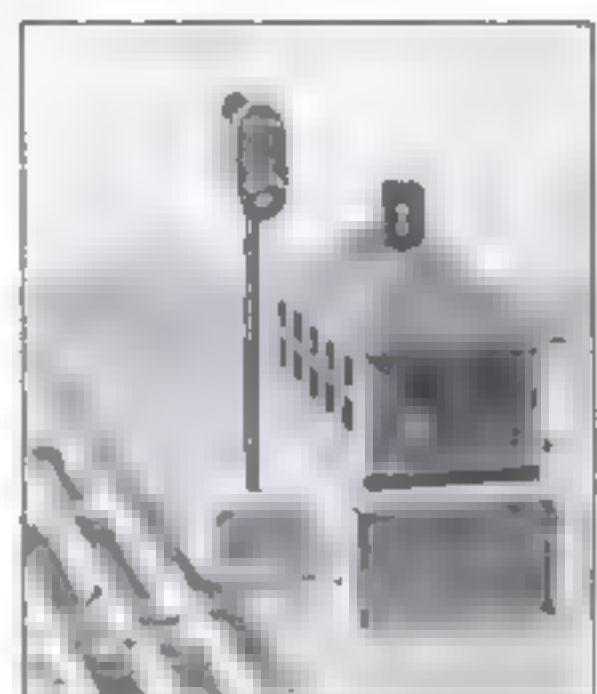
OPERATING MODEL TRAINS ON GRADES

IF YOUR model railway track layout includes grades, you have to move the rheostat every time the train reaches the grade and then move it back to its original setting when the train reaches the top of the ascent.

When the grade is not too steep and the locomotive can climb it merely by a change in the rheostat setting, the solution of the problem is to add another rheostat which can be used to control the current for the grade ascent (remove third-rail pins to isolate grade section). This arrangement is shown at A. Of course, if you are satisfied to keep the train always the same weight—or in other words always use the same number of cars—you can dispense with the rheostat control of the grade. In that case you set the connections to the transformer so that the train will climb nicely with the rheostat turned all the way on. Then you wire the grade direct to the transformer and use the rheostat to control only the level going as shown at B.



Three ways to control grade power. In each diagram wire X leads to section of third rail on grade, wire Y goes to third rails of level track, and wire Z to the running rails.



In the base of this little signal tower are hidden the automatic block signal controls.

The base of the tower should be made high enough to clear the solenoid coils, and the upper structure should be removable.

The walls of the upper structure are 3 in. high. The window frames are small strips of wood glued in place and the windows are glazed with thin celluloid or cellophane. Shades of green color are fitted inside the windows to cover the upper house.

The color combinations of painting the house will depend, of course, on the location of the signal. If you are making a model, care

Wiring connections are made to the wires with spring clips fastened to the front of the insulation. H. K. S. Bussey.

TRAINS ON GRADES

In case you want a still more flexible connection to the rail and set the rheostat for the grade, apply just enough to start the heaviest train you will ever want to run, as in diagram C. The speed of climb on the grade can then be held down by the rheostat. The other rheostat should be set to a different point in the transformer—one that uses lower voltage. This arrangement is useful in certain not too steep grades where the track with both rheostats turned all the way on, as there is a momentary low-voltage short circuit each time the double contact of the locomotive bridges the third rail of the grade to the third rail of the level portion of the track. E. W. O'Connor.

GARDEN HOSE SIPHONS WATER FROM CELLAR

RECENTLY I had to siphon water from my cellar, but found it difficult to start the flow through 75 ft. of hose. I finally hit upon the following method, which proved successful.

Connect the hose to a faucet and run it down to the bottom of the water that is to be siphoned. Here there must be a coupling in the hose that can later be disconnected. From this low point, carry the hose up again and through a door or window to the outside. Make sure, of course, that the outside end is lower than the lowest point of the water to be drained. Turn on the water at the faucet and let it flow freely through the entire length of hose. While the water is flowing disconnect the joint that is under water in the cellar and be sure to keep the hose under water while doing this. The water will then continue to flow. Don't forget to turn off the water at the faucet. E. R. Bawlow.

MARKER LIGHTS IMPROVE OBSERVATION CARS

MANY of the model railway observation cars now sold are fitted with red celluloid disks to represent marker lights. In some of the more elaborate models a back platform light is added, and this is supposed to illuminate the red disks.

The effect can be much improved, however, by fitting an electric bulb directly behind each marker disk. The regular model railway light bulbs are rather large for this purpose. I suggest either telephone switchboard pilot lamps, if you can get them, or the small cylindrical bulbs used to light the dials of radio receivers.

The accompanying photograph shows a novel form of socket made to hold a radio



The end of an observation car with the roof raised to show one of the small marker bulbs

dial light bulb. Copper wire of No. 14 gauge or radio bus wire is wound into the threads of the base of a bulb, and the end is formed into a clip that slips over the rear car partition. By careful adjustment, the bulb can be so located that the filament will come directly behind the red disk, yet the base of the bulb will be up near the car roof and virtually out of sight. A little black lacquer, carefully applied to the bulb, will cut off all light except that going through the red disk.

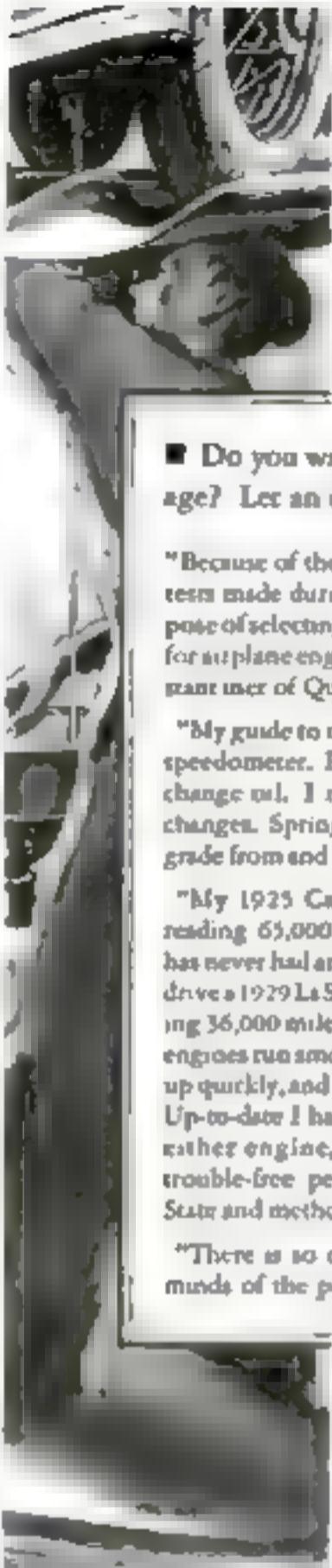
The most economical operation is secured by connecting the two rear marker lights in series. This can be done by putting a piece of heavy brown wrapping paper under the clips to prevent shorting on the rear partition. Then the two clips are connected together with a short piece of insulated wire. The end of a piece of wire should be soldered to the center terminal of one of the bulbs, and the other end of this wire should be grounded to the car frame at any convenient point.

If you use 5- or 6-volt bulbs, you can connect the center contact of the other bulb directly to the wire that supplies the other car light. If you use 2½-volt bulbs, the two in series require 5 volts, and if your trains operate at about 12 volts maximum, as, for example, on an "O" gauge line, you will need a fixed resistance of about 14 ohms in series with the two bulbs. For "standard" gauge, where 18-volt bulbs normally are used, the two dial light bulbs would require a fixed resistance of 26 ohms.

Small fixed resistances suitable for this service can be obtained at any radio service shop. If you can't get the resistance you want, take the next higher.—R. L. H. (cont.)

"DOPING" MODELS WITH SHELLAC

A good substitute for model airplane "dope," I have found, is white shellac thinned with alcohol, provided it is applied after the plane has been shrunk with water. It makes a very strong bond, and I could never detect any difference in weight.—Lynn G. De Soto.



Spring Oil-Change?

■ Do you want to save money on repair-bills? Get long-term mileage? Let an engineer tell you the importance of proper lubrication:

"Because of the outcome of a series of tests made during the war for the purpose of selecting oils that were suitable for airplane engines, I have been a constant user of Quaker State.

"My guide to motor lubrication is the speedometer. Every thousand miles, I change oil. I never add any between changes. Spring and Fall, I change the grade from end to Cold Test. That's all.

"My 1925 Cadillac, speedometer reading 65,000 miles approximately, has never had any engine repairs. I also drive a 1929 LaSalle, speedometer reading 36,000 miles approximately. Both engines run smoothly and quietly, pick up quickly, and climb the hills in high. Up-to-date I have not spent a cent on either engine, and I attribute this trouble-free performance to Quaker State and methodical lubrication.

"There is so much confusion in the minds of the public about motor oils

that I thought perhaps you would like to have the actual experience of a real long-time user."

When you give your motor its Spring clean-up, change to Quaker State Motor Oil and stick to it. It's a money-saver.

Avoid common oil. Every gallon averages about 3 quarts of motor lubricant and 1 quart "light-end" oil. This light-end oil burns up in high-speed, high-compression cylinders after a hundred miles or so.

Quaker State takes out this light-end material...at the refinery. You get 4 quarts motor lubricant per gallon, net. After a hundred miles or so, you still have 4 quarts.

Look for the Quaker State sign. Most places now supply Quaker State from the patented green-and-white drums...double-sealed at the refinery.

QUAKER STATE
MOTOR OILS
and Superfine Greases

"What's your experience? Write us.
Quaker State Oil Refinery Co., Oil City, Pa.

MAKE YOUR OWN JIG SAW PUZZLES!

NEW 10" JIG SAW

\$4.50

The standard pattern saw
is a fine tool for cutting
any kind of wood, and
is especially useful for
making jigsaw puzzles.

Puzzle Kit
Complete kit for making a
puzzle. Includes saw, puzzle
board, glue, and tools. **\$1.75**

Delivery \$1.00. See page 21 for post office address. Satisfaction guaranteed.



Bosch! Order Today, Too.

Send for our free catalog of tools and garden equipment. It contains many unique, interesting, dependable products that will pay handsomely in service. Wish for catalog. You may receive a sample catalog free. Write to: Bosch Electric Corporation, 14742 Mayfield Avenue, Toledo, Ohio. Tel. E. 7-5125.

W. G. & J. BOSCH CO., TOLEDO, O.

The 10" Jig Saw has
the new work well design
which permits uniform
speed in cutting and
eliminates the need for
constant hand control.

It has a quick-set
blade holder which
permits instant
changes.

It has a built-in
blade sharpener.

It has a built-in
blade sharpener.</

IN A JIFFY

THIS NEW KIND OF WOOD
expertly mends breaks,
hides nicks, seals cracks.

Does Everything Glue Will Do
—Does It Better, Quicker

Right out of a can comes this amazing new preparation that handles just like putty, does everything putty and glue can do—and quickly hardens into wood. Waterproof, life-lasting wood you can carve, paint, turn in a lathe. Wood that takes and holds nails and screws better than most natural woods.



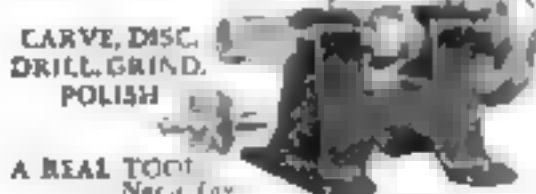
nicks, holes, wood-rot—and do it in a way you'll be proud of. **TILBKE'S NOTHING BETTER FOR MAKING MODELS.** Get a can or tube of PLASTIC WOOD (9 colors to choose from) at any paint, hardware or department store today!



PLASTIC WOOD

Handles Like Putty—Hardens Into Wood

CHANGE ATTACHMENTS
Instantly



CARVE, DISC,
DRILL, GRIND,
POLISH

A REAL TOOT
Now a Day
MASTER BENCH HEAD

Each attachment is mounted on a mandrel and is replaceable in moments. To change attachments, merely turn the handwheel and drop into place in seconds. 5 ft. price \$4.00

Special Offer: Bench Master or Master Bench Head
plus K. P. and C. C. all-in-one combination
half discounted on separate purchase. Price of \$6.00

WISCONSIN ABRASIVE COMPANY
Dept. 86-A Milwaukee, Wis.

Brand New **NOW \$19.75**
ONLY
TYPEWRITER
Guaranteed
REMININGTON
Semi-Glossy Case, Low
Rate, and Easy Return
if you're not satisfied.
Send No Money, 14 Day Trial
Send for more information and other details.
Order by Mail or Phone. Pay down, pay off
a day. When you buy in Remington Case, you get
postage free. Write for details and special money-saving offer.
International Typewriter Exchange, Dept. 407, Chicago

Decorative Double-Duty Candlestick

By Lee M. Klinefelter



Copied from an antique model, this unusually graceful candlestick can be hung up or laid down

THOUGH the days of candles are long past, an attractive candlestick is still welcome in every home, and in emergencies it may prove useful as well as ornamental. The one described here is adapted from an antique model and differs from the usual styles in that it may be either hung on the wall or set on the table or mantel.

The shield is cut from a 435 by 6 in piece of 18-oz. soft copper. In this as well as the other parts, however, the exact weight of copper used is of no great importance. The shield should be lightly spotted all over with a small ball peen hammer. Then place the shield between two boards and flatten it by striking the top board with a heavy hammer.

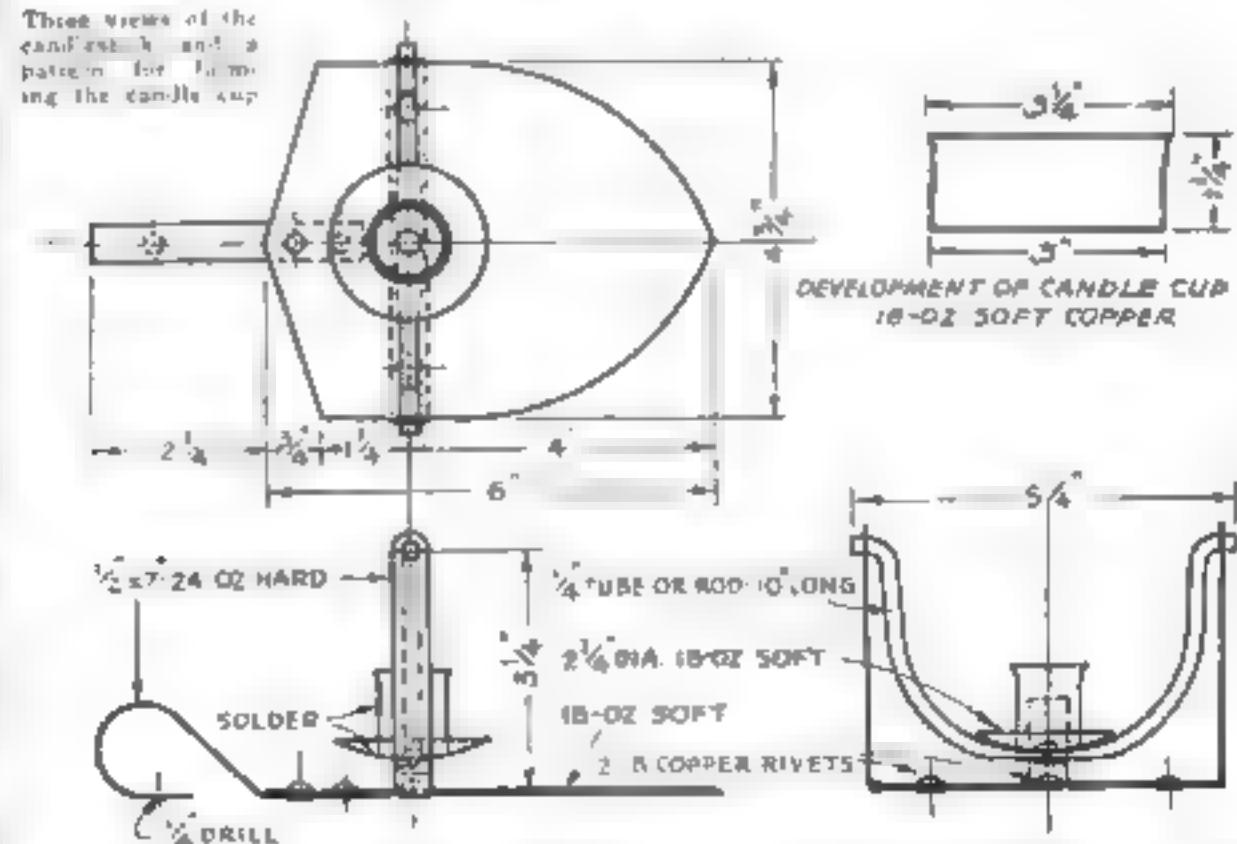
The handle is made from a ½ by 7 in piece of 24-oz. hard or cold-rolled copper bent to the shape shown in the drawing. The U-shaped bracket is made from a ½ by 12 in. piece of the same material rounded at the ends and bent to a right

angle 3½ in. from each end. A ½-in. hole is drilled ½ in. from each end. The handle and bracket are riveted to the shield in the positions shown with two 2-lb copper rivets in each. Then turn the edges of the shield down slightly all around so that it will rest flat on the table.

For the drip cup, cut a 2½-in. circle of 18-oz. soft copper and hollow out with the ball peen hammer over a hole gouged in a block of soft wood. The hanger is made from a 10-in. length of ½-in. copper rod or tubing. Shape as shown and flatten at the bottom enough to allow for the rivet hole. Drill a rivet hole in the center of the bottom of the hanger and another in the center of the drip cup, and fasten them together with a copper rivet.

The candle cup is cut as shown in the drawing and rolled into a cylinder. The top edges are then flared out. Take pains to form a smooth butt joint all the way up the side. Solder on the inside, using tin acid or soldering paste as a flux. Place the candle cup in the center of the drip cup and solder around the bottom using as little solder as possible.

The candlestick should now be cleaned with fine sandpaper emery cloth or steel wool and wiped lightly with white shellac or lacquer if a bright finish is wanted. If an antique finish is preferred, wipe with vinegar or any dilute acid and let it oxidize until the desired shade is obtained. After finishing, spring the hanger into the holes in the bracket, and the job of making the candlestick is done.



SUMMER COTTAGES \$156⁰⁰
 Hunter's Lodges \$82⁰⁰ UP
 Tourist Cottages \$82⁰⁰ UP
 Many Sizes
 and Designs
 All Materials
 Read-Cut
 We Pay Freight

The ALADDIN Co. Mail this Coupon!
 Bay City, Mich. (Aladdin design office) Portland, Ore.
 Send free, without obligation, new Catalog of Homes,
 Summer Cottages and Garages, No. 10.

Name _____
 Street _____
 City _____ State _____



Two Big Factories
FULL LENGTH SPRAY BALES SOMETHING NEW
 A T.V.T. family Outboard motor boat with full length spray rails built to a fine and time proven blue watered, high go Marlin.
 Catalog Free—Save Money—Prompt Shipment
 Please state kind of boat to which you are interested.
THOMPSON BROS. BOAT MFG. CO.,
 819 ~~Long Island Avenue~~ (Waterplace)
 Providence, Rhode Island, NEW YORK

BUILD "GOLDEN HIND"

Make a whitewhale $\frac{1}{16}$ scale model. You'll spend hours in drawing up the true line of profile & plan of "D". Also how to cut bulkheads, stringers, deck, and hull. The curves fully shaped and raised with curved tenon tools, plus other tools required. The plan includes gun ports, rigging, hatches, etc. It is a complete kit, ready to assemble. The price, \$10.00, is for the plan only. Add \$1.00 for each yard of lumber for the sailing spars and other materials.

ROY HANCOCK
 373 S. Douglas Ave. Portsmouth, Va.

FREE CATALOG
Just off the press

Fully illustrated showing furniture and clothing for camping and fishing. Also other items alike for camper and fisherman.

L. L. BEAN,
 210 Main St.
 Freeport Maine



Tricks With Electricity
 Make things spin, jump, kick, burn, shoot, think back, move up—all by electricity. Make lights, color, video, television, trick lights, dancing girls, spirit rapping—all kinds amazing, practical devices. Book tells how to do 200 stunts with 10 volts A.C. Postpaid \$1.
CUTTING & SONGS. 42 pgs. CAMDEN, ME.

Big 3ft Telescope

Rudy Moon Plans and elegant objects with this great 10 ft. 3 ft. telescope. It's a great gift for testing your building FILE. Makes an ideal microscope. Guaranteed big value. The price is \$3.00 extra.
BERNER & COMPANY 344, TRENTON, N.J.

MODEL OF THE FAMOUS GALLEON REVENGE

(Continued from page 87)

D, as shown on the deck plan, from 1-in wood. This goes back to the high vertical projection of A. While this deck may be solid wood it is better to cut it in the form of a cradle as shown in the detail of the forecastle and forecastle deck. The way I make these cradles and those for the hatches is to mark them off on plywood, then cut along the lines with a sharp knife through one ply and park out every other strip starting with the second from the wide edge. Next I free saw right across and take out every other cross-piece starting at the edge. Finally I glue back the lifted-out pieces.

THE thwart bulkheads are made from the waste of A. They are of the same size as the designs for the overlays shown excepting J and K, which have to be wider and cut with a bevel to conform to the hull lines. The height of the bulkheads is, however, only the same as the corresponding vertical parts of the centerpiece.

First cut and fasten bulkhead G in position. Then, from $\frac{3}{4}$ in. wood, cut deck F. This extends from the second bulkhead to the third, but also continues under the third to the mizzen mast. Cut a slot down the middle as far as necessary to slip it over the vertical projection of A. This extension is required to hold the after gun carriages. It is desirable but not essential, to glue blocks of wood under the ends of this deck to support it. On this deck erect bulkheads G and H. Then fasten bulkhead J, but note J starts down on blocks B. It should have cross bars on it to support deck K, which is now fitted and applied.

Next fasten on decks L and M. The sizes of the decks can be obtained from the deck plan, but it is best to try them out in cardboard before cutting the wood. See that the bulkheads and decks give the contour shown in the upper part of the body plan. The double lines on this plan represent the bulwark pieces, which are added next. All decks can be scribed with lines $\frac{1}{4}$ -in. apart to represent planking.

While not altogether necessary, it is advisable to nail and glue a couple of pieces of wood to each rule to support the bulwarks and stem boards. These will roughly conform to the outside of the body and profile B.

The bulwark pieces port and starboard are cut from 1-in. plywood. The outlines and pattern can be marked on one piece $4\frac{1}{2}$ by 10 in. Another similar piece can be nailed to this and the two be-sawed at once. Before sawing the outline cut out the gun ports and rail openings, if necessary filing them clean and square. When cut the color pattern will have to be drawn in reverse on the port bulwark. These might well be painted, in part at least, before they are applied.

IT IS not necessary to adhere strictly to the pattern and color scheme given, although it is typical of the period. Some green should be retained in any case, as it is the Tudor color. The long tops are wales and will be applied later, except the one running through the upper gun ports, which is only painted on. The gallery door can be outlined with V-cuts, and similar lines can be drawn around the gun ports. The lowest wale on the bulwarks is a dummy only, outlined with a V-cut.

Be very careful not to let the paint get thick and shiny anywhere.

Run a pencil line around the hull $\frac{1}{2}$ in. from the top. Apply glue to this part and to all the edges of the bulkheads and decks and to the corresponding parts inside the bulwarks. Then lay the bulwarks in position to the pencil line, beginning 1 16 in. before bulkhead E. Continued on page 93.



FACING situations which test the most iron nerve is an accepted part of the news reel photographer's work.

And in industry, meeting stiff conditions—conditions which demand stamina that only the finest quality can give—is part of the file's work.

Made of the finest file steel, Nicholson Files are tested repeatedly for the quality which enables them to make good on industry's payroll.

Filing ability that shows a net profit on each filing job is found in every Nicholson File.

At hardware and mill supply dealers. Nicholson File Company, Providence, R.I., U.S.A.

Genuine
NICHOLSON FILES
A FILE FOR EVERY PURPOSE

HOW YOU CAN SAVE MONEY



Today everyone is looking for a chance to save money, and here we tell you how you can save many dollars by shining your shoes at home. A good shine on your shoes not only makes them look a lot better but actually preserves the leather and makes them wear longer.

Our handsome homeshine kit is worth 60¢, but the coupon below will bring it to you for only 26¢, a big saving right at the start! It has a real leather duster, a genuine auto's wool polisher and a big tin of high-grade paste polish. Paste polish is best for most shoes, but for kid shoes we suggest Bixby's Linenush. Don't miss this money-saving opportunity. Clip the coupon now!

2 IN 1 • SHINOLA

The logo for Bixby's Shoe Polishes consists of the brand name "BIXBY'S" in a bold, serif font, with "SHOE POLISHES" in a smaller, sans-serif font below it. The word "BIXBY'S" is flanked by two circular emblems. The emblem on the left depicts a landscape scene with a bridge over water and trees. The emblem on the right shows a close-up of a polished shoe with a prominent crease.

2-4-1-Brown & Beery Co., Dept. B-1
101 East 42nd Ave., New York City. Enclosed find
list of names of our Help from our Bureau in
New York.

Widiputra

non-slip floors Our safe kind is made fully non-slip by treating with Al-Quick Drying Varnish. Now, fulfilling the popular demand, we offer, treated, impregnated and varnished, oak floors, linoleum, formica and wood work. Also in clear glass dull finish and varnished surfaces. Other Al products. For example, Quick Drying Epoxy, Quick Drying Spec Varnish, Color cards sent free with catalogues, please see request. Please send us your drawings.

Algonquin Park
100, Tongwanda
4 feet. Buffalo
N.Y. 100 yards.
100, Cuddebackville
4 feet. Her
krie, Ontario.

**PEATTY & LAMBERT
VARNISH PRODUCTS**

THESE EASILY MADE
Little Tables
Nest Together

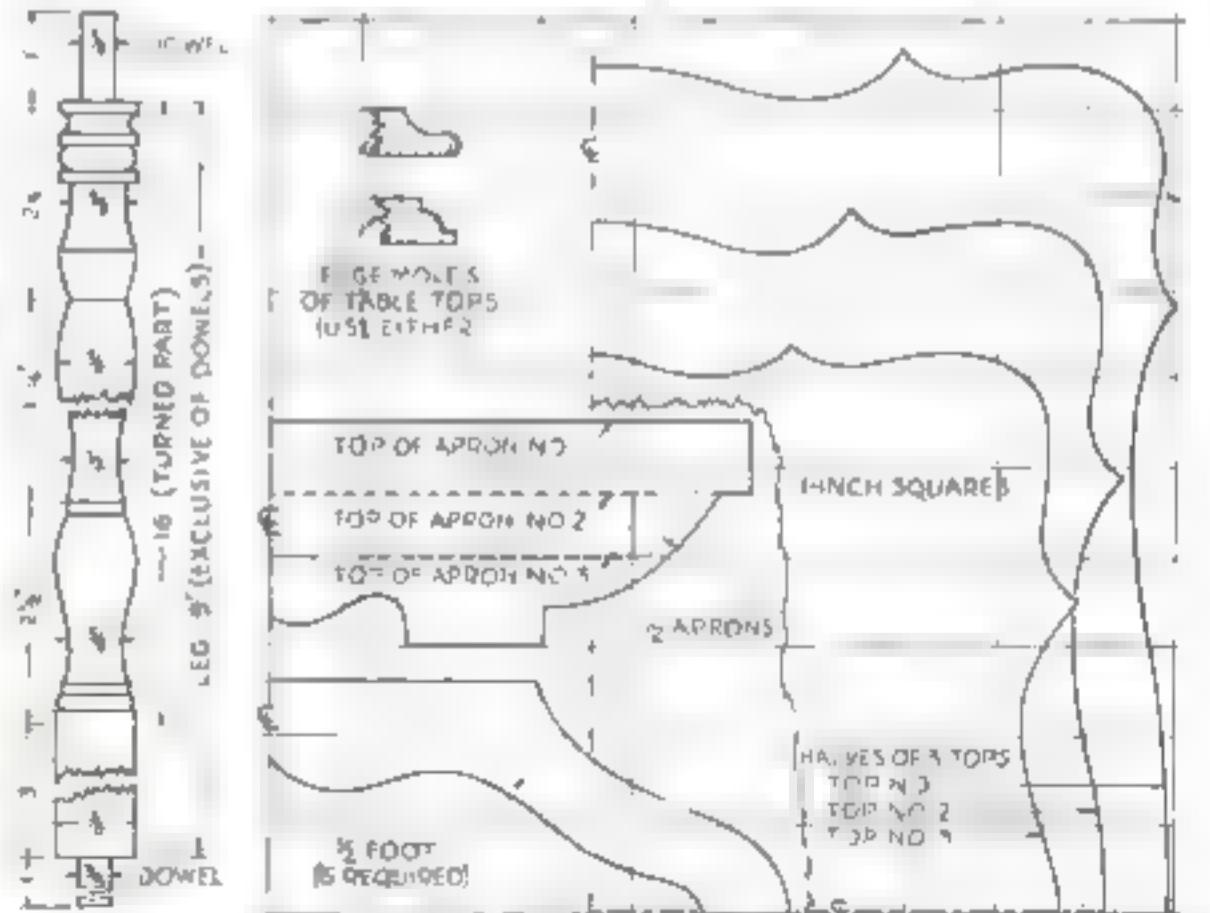
TO SAVE SPACE

WHEN nested together, the tables illustrated occupy little floor space. They have artistic lines, are simple to make, and will prove decidedly useful in any living room.

The patterns are similar for all three except that the top and aprons are progressively cut down for the smaller tables. As the leg turnings are rather light being only $\frac{3}{8}$ in. square it may be advisable for the amateur turner to have these turned by a professional. The extra cost will amount to little in the writer's case the turning, hand-saw work, and molding of the tops cost only \$3, not counting the value of the wood. Figured walnut makes a most handsome set, though other woods, of course, may be used. A fine set may be constructed of basswood and lacquered.



The three tables are alike in design, the main difference being in the size of the top and the actions.



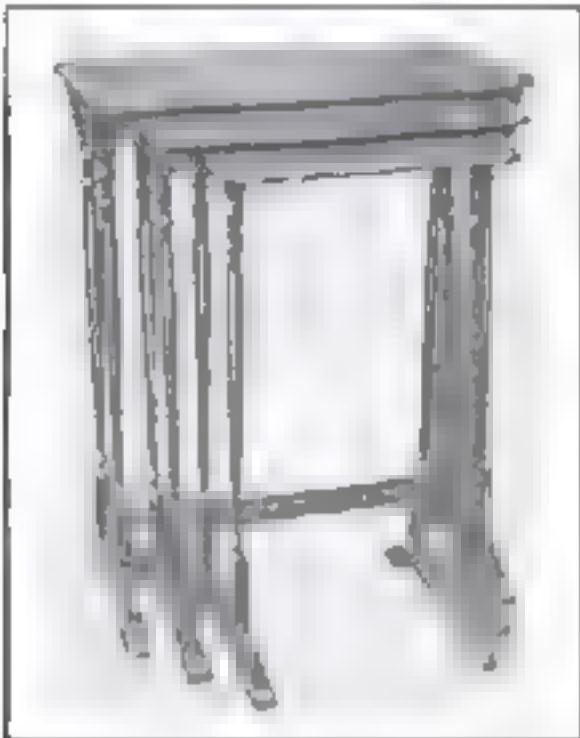
The following stock is required for a set of three tables, all measurements being in inches: 17 legs, 21 long, $\frac{3}{4}$ thick, $\frac{3}{4}$ wide (this allows for a 1-in. dowel on each end); 6 feet, $11\frac{1}{2}$ long, $2\frac{5}{8}$ wide, $\frac{7}{8}$ thick, 2 aprons 1 long, 2 wide $\frac{7}{8}$ high, 2 drawers 10 long, $1\frac{1}{4}$ wide, $\frac{3}{8}$ thick, 2 aprons, 9 long, 1 wide $\frac{3}{8}$ thick, 1 top 19 long, 13 wide, $\frac{1}{2}$ thick; 1 top $15\frac{1}{2}$ long, 12 wide, $\frac{1}{2}$ in. thick, 1 top $12\frac{1}{2}$ long, 11 wide, $\frac{1}{2}$ thick; 3 slats, 10 long, $\frac{1}{2}$ wide, $\frac{1}{2}$ thick, cut to fit each table; scraps for making the slides or

Then the stock is all cut to

size and to the patterns, then scraped and sanded to a smooth finish. The feet and aprons are next bored to receive the legs, which have had a $\frac{3}{8}$ -in. dowel turned on each end for this purpose. It will be noted that the thickness of both the feet and the aprons is the same; and in centering the holes for the legs, it is well to line up the aprons and center the holes on their squares first, and then transfer these centers accurately to the feet. In this way it is certain that the legs will line up and be parallel. One end of both the aprons and the feet should be marked for easy identification.

The aprons are also bored with two screw holes near each end for the screws which fasten the table tops to them. These holes may be plugged with a plastic wood composition before finishing. One quarter of an inch should be cut off the bottom of the feet of each of the smaller tables so that the feet will not drag on the floor when nesting the tables.

The assembly is started by gluing the legs to the aprons and feet, and then pairing off. The pair with the deepest apron is fitted to the large top, 16 in. apart, using the second table top as guide. Then



The tables fit together compactly when set in use and take up very little floor space

the slat is glued in position on the bottom of the legs. Gluing and clamping is sufficient to fix this slat, which serves as a back stop as well as a brace. The sides are now glued and nailed in position, the second top still being used as a guide. Allow sufficient play so that the table will slide easily and not jam. The other tables are assembled in a similar manner. The sides, of course, are omitted from the smallest table, and the slats are placed with reference to those already on.

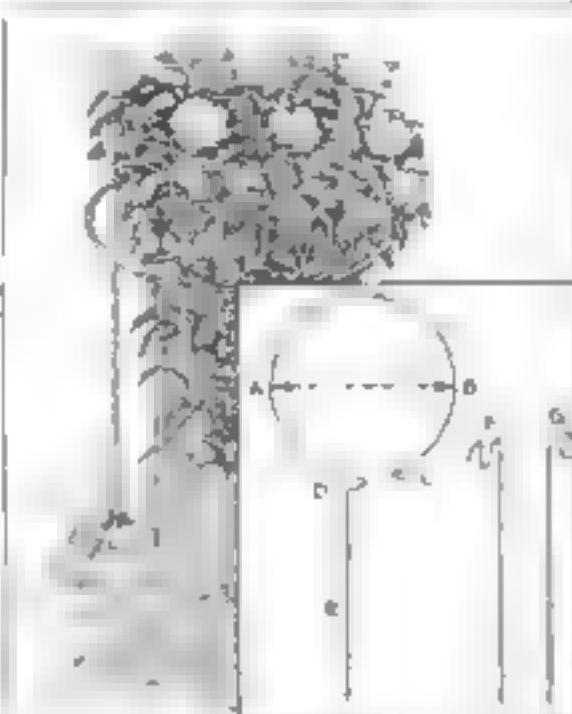
Walnut, if used, should be oil stained, filled, shellacked, and varnished. Either a rubbing varnish or a flat-drying varnish may be used.—H. CALDWELL.

AFTER a hole has been drilled in glass for any purpose, cover the inside edges with transparent household (celluloid) cement. When this is dry, the hole will be surprisingly smooth and glossy, as if it had been melted through.—K.M.

NEAT LOOKING SUPPORT FOR BUSHY PLANTS

FREQUENTLY an otherwise attractive garden is ruined by unsightly flower supports. While supports are often necessary, they need not be eyesores. For several years the writer has used the homemade support illustrated, which is especially useful with peonies.

Wire of No. 9 gage, which can be bought from most hardware stores, is



An inexpensive and easily made support for peonies and other large, bushy garden plants

used. As the wire comes in circular coils, one round is first pulled together so as to make a circle as shown, with *AB* the diameter of the bush to be supported. For a fully developed peony bush, this is usually about 3 ft. From *D* the wire is straightened out along *E*. Make *E* 8 or 10 in. longer than the height at which the supporting circle is to stand above the ground. For a mature bush, *E* will be from 7 to 3 ft. A file may be used for cutting this heavy wire.

Before setting the support, the extended part *E* is bent so that it will be perpendicular to the plane of the circle. The hook at *C* will then catch easily into notch *D*. Press the straight part *E* into the ground near the bush, but on the side opposite to that from which the bush is usually seen. Then open up the circular part, sweep the free end around the bush, draw it tight, and fasten the hook.

Two or three stakes like *F* or *G*, of the same length as *E*, are set at equal intervals around the bush to help hold up the circular wire. Support *F* is a little simpler both to make and to adjust, but support *G* is surer to hold. A yet different stake support is formed by pulling the point of the curved part at *G* out, and also upwards a little.

It is well to put up these supports when the peony buds begin to form. If the blooms are especially heavy and tend to droop over, a second support with a longer straight wire *E* and a little smaller circle *AB* can be fitted about the top of the bush. After the plant has bloomed this second support may be removed. As the supports are taken up the straight wire is again bent back for hanging against a flat wall.—THEODORE LINDGREN

Stairs go up



but now you take an

ELEVATOR

THIS elevator brought me a new idea of cushioned speed. It took away all the jolts and weariness of climbing stairs.

Squibb Shaving Cream will give you a new idea of shaving speed and ease because it's designed along the same principle.

Squibb's limbers up the shaving process. It cushions the razor in its creamy lather and makes it slide along with ball-bearing smoothness.

And see how grateful your skin will feel! Not only for this extra comfort while you're shaving, but for the extra velvety feel and downright ease that always follows a shave with Squibb's. This modern shaving cream contains oils essential to the comfort of the skin.

For speed . . . for ease, shave with Squibb's.

Send 10 cents for a generous guest-size tube to E. R. Squibb & Sons, 2304 Squibb Building, New York City.

* And top off with Squibb Talcum — scented or unscented.



Goodbye SANDPAPER CHIN



Here
Comes
the New

DURHAM DUPLEX SAFETY RAZOR

EVERYBODY wants an ALL DAY shave—and here it is! Try this NEW razor—and get rid of that "sandpaper" feeling that comes a few hours after shaving. It's all in the long blade—the shaving angle—and the design! Simple and sure. Nothing to learn just shave! Note these important features:

- 1. EXTRA LONG double-edge blade
- 2. PERFECT BALANCE
- 3. CORRECT SHAVING ANGLE
- 4. NO VIBRATION
- 5. NEW HANDY GRIP HANDLE
- 6. EASY TO CLEAN

DURHAM DUPLEX RAZOR CO.

Newark, New Jersey • Canadian Office
into Canada • Sheffield, England
1000 Durhams per box

Sensational low introductory Price

25c

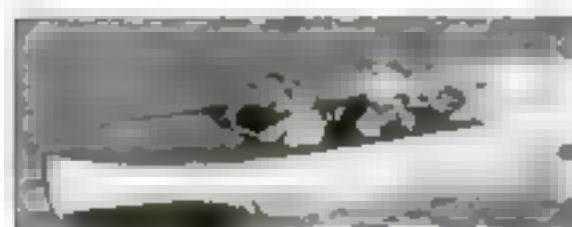
with One Blade from your
dealer or mail this coupon to:

Durham Double Razor Co., Jersey City, N.J.
Enclose 25c cash or stamp. Please send postcard
New Durham Double Razor complete with one blade.

Name _____
Address _____
City _____ State _____ Zip _____



PLOWING A FURROW IN FIELDS OF FISH



A boat for the fisherman—no fisherman need—it is a boat to be used with lake—surrounding its rocky bottom. It is built of wood, not lacquered, the body is light, and the interior is everywhere to make a seat in front of the kitchen. The front is often built in such a manner that it can be used as a shield, and water won't get in. There are no expenses in keeping it.

There are many different models for every use. Prices as low as \$20. Write for the free catalog showing big, little, swimming, all-round types for family use, open-deck boats for sportfishing, Alaskan rowboats, and dories. Write today. Old Town Canoe Co., 404 Fuhrer St., Old Town, Maine.

"Old Town Boats"

AMUSING NOVELTIES

Turned on a Lathe

By F. Clarke Hughes



All parts of this curious little figure except the feet are either wholly or mainly made by turning

MADE almost entirely on the lathe, this little figure of a Chinaman bears a tray that may be turned to a size and shape suitable for holding either a metal ash tray an incense burner or a container for cigarettes. The figure also might be used as a novel sewing kit a small tray or wire being set between the hands to hold one or two spools of thread. In this case it is suggested that the size of the base be enlarged and turned in the form of a shallow tray for pins and buttons.

Clear white pine is suitable for making this piece. Turn all the parts before fitting them together. When the main block has been removed from the lathe and before the two centers are cut away from the ends a straight line should be drawn on two opposite sides of the piece in order that the joints may be kept symmetrical in straightening the block during the gluing process. Fasten and glue together

the body parts; then add the ankles and the feet, which are made separately.

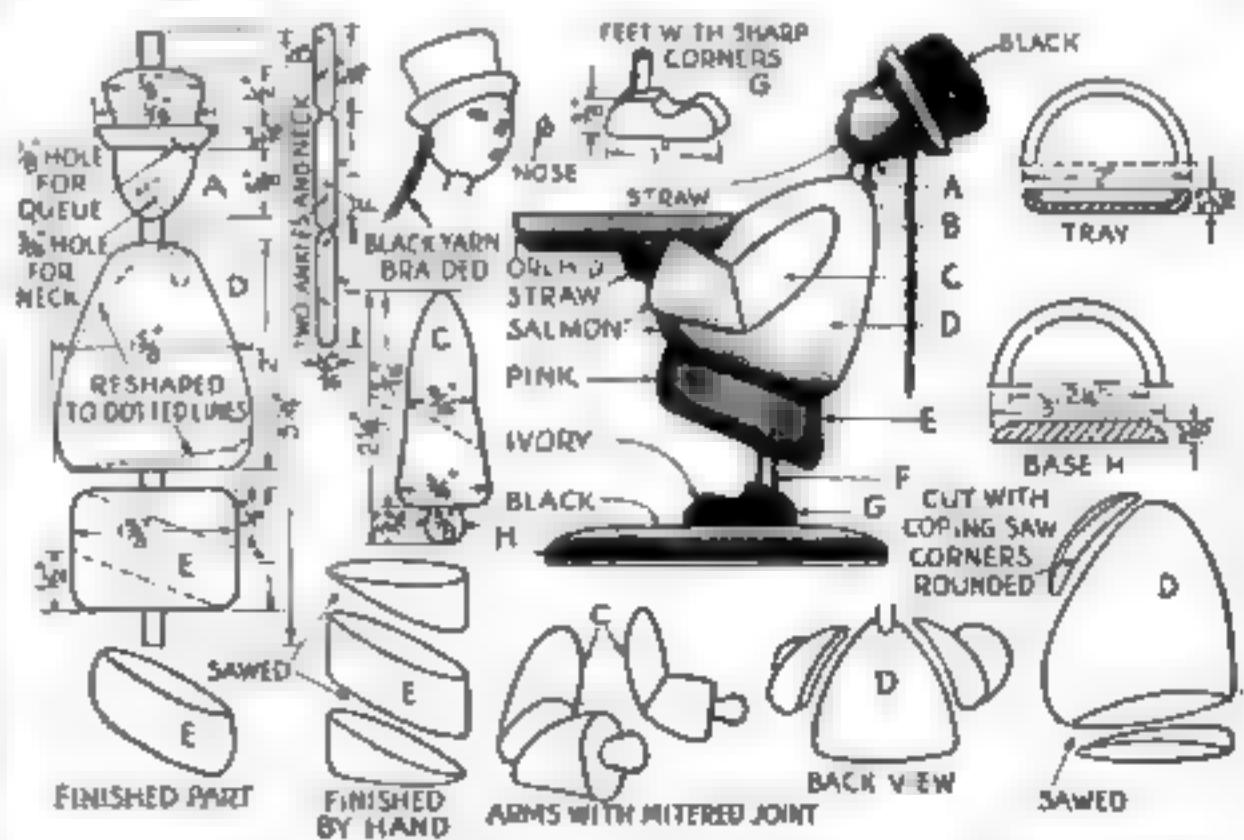
A small notch should be carved in the front of the body to fit the tray, if used, so that it will rest firmly at the correct angle. It should be glued and nailed to the body before the arms are put in place.

The arms should be cut and fitted at the elbows as shown. This joint may be glued and reinforced with a small brace. The upper part of the arm should be shaped with a sharp knife so to be save of the body and, at the same time, to give the hand the appearance of having stepped to the tray. A small notch should be cut in the hand where it touches the tray.

A lacquered finish is best for this piece, but before the first coat is applied all of the parts should be smoothed carefully. Any small holes or depressions should be filled with a plastic wood composition or other hard-drying filler, such as glue and sawdust. Ordinary paint is not safe for this piece of work for the oil in it will come through and spot the lacquer badly.

The whole should be given a light colored undercoat of any kind suitable for use under lacquer, or a coat of white or straw-colored lacquer will serve the same purpose. A decorative color scheme is suggested in the drawings, but many variations can be worked out. For example, the hat may be colored in two shades of blue—dark blue for the crown and a lighter blue for the rim.

A piece of felt should be glued to the base as the finishing touch; it will protect from scratches the table or stand on which the figure is placed.



How the head and body are turned in one piece and the body is later shaped and assembled by hand; details of arms, feet, ankles, and neck; and suggested designs for the base and tray

Electric Telegraph Set 15c BOYS!



WORLD NOVELTY CO. Dept. 882, Rochester, N.Y.

\$1.49 Jig Saw

Plus Set of Adapters

and 12 Assorted saw-blades
Blades from .006" to .012" in thickness.

Adapters enable you to use the
jig-saw in all the ways of
drills—drill holes, cut out
patterns, or puzzle marking.

You have opportunity for your ingenuity or humor. All metal con-
struction, 12" long, 4" high, 6" wide. Send postpaid
for sample of \$1.49, \$1.12, \$1.24 outside U.S.A. \$1.44
Price booklet "Make Your Own Jig-Saw Projects" 10c
postage.

R.P.C.L. (Rochester Plastic Company) 100% Plastic Outfit, including
all metal adapters, blades, and tool kit. Price \$1.49
plus postage. Send 10c postage for booklet "How to Make Your Own Jig-Saw Projects".

J. & H. Metal Products Co., 490 St. Paul St., Rochester, N.Y.

12 In. Flying Models

Father To Flyer—Biplane—Pap Mch.
Papier Mache—Fighting Plane—Pap Mch.
Papier Mache—Fighting Plane—Pap Mch.
Papier Mache—Fighting Plane—Pap Mch.
Send to the Captain of AN IDEAL Model
IDEAL AEROPLANE & SUPPLY COMPANY, Inc.,
38 West 19th Street, New York, N.Y.

BUILD A MODEL POWER BOAT

Model Power Boat Kit—\$1.00
Model Power Boat Kit—\$1.00
Model Power Boat Kit—\$1.00
Model Power Boat Kit—\$1.00
SEATTLE MODEL BOAT CO.
Dept. B, P. O. Box 333, Seattle, Wash.

DEFEND YOURSELF

Regulators of size or strength. Defend yourself and
friends against gas, fuel, steam, fire, lightning or the
like. White cloth insulation with copper binding and
admirable heat resistance. Even 100° Fahr. & more. A
complete range of approved American F. & I. codes
from the International, Adams, and Standard
Manufacturing with detailed instructions, prices
from 10 cents to \$100.00. Complete catalog. Only \$1.00.
One dollar full price. If you send us \$1.00
cash with order in stamps and money order.
B. J. JORGENSEN
1526 MARSHFIELD ROAD SEATTLE, WASH.

**100% PROFIT Building
NEW BOAT in Days**

With 100% Profit on most \$10.00 Model
Sail Boats you can't afford to miss this
book. It contains complete building
instructions for 100% profit sail boats
from \$10.00 to \$100.00. This
is the easiest way to earn
money. Actual photos and drawings
of boats. Plan. When you have
finished it, you will be a
Master Boat Designer. \$2.50
Market. Send \$2.50. Shipping \$1.

This is written to
the inch, the
smallest detail
has been accepted
in this magazine.
Small advertisements of one or two inches produce re-
sults of many times their cost for hundreds of compa-
nies of all kinds who have revolutionized life or the
mechanical equipment tools, garage puzzles etc. well and
fast from nothing. We receive thousands of small advertisements like this
one. If you think you can do better than the boat and sail boat
advertisers with whom we have ever dealt, send us your part and we will be pleased to publish it. Advertising Department, Popular Science Monthly, 125 Fourth Ave., New York, N.Y.

WHAT CAN YOU DO WITH ONE INCH?

"CHARCOAL" PORTRAITS MADE WITH CAMERA

(Continued from page 78)

density of your positive, degree of enlargement, and strength of enlarging lamp, but remember that process plates are considerably faster than bromide paper.

After exposing the enlarged head upon the plate, develop the negative until it appears very dense and black against the orange light. You will now do well to make a contact print to see what handwork it requires before enlarging it as a "drawing."

Use a fine-pointed brush and some dark, opaque water color to spot out (on the gelatine side) any pinholes that the proof shows in the negative. Also paint out the background around the head so that it will come out as clear white paper in the final "drawing."

When the spotting is complete, put the negative in the enlarger and project the head in the center of an 8 by 10 in. sheet of bromide paper. Rough surface paper is best because it looks more like charcoal paper.

As a safeguard, it is well to experiment by exposing small strips of bromide paper until a fairly long development produces a clear black and white "drawing" effect. Then expose your big sheet, and your sketch is made. When dry, you can add a few sketchy background lines with a black wax crayon, and use it also to sign your "drawing."

This process enables you to make considerable changes in the original negative. Experience will show you how much contrast is required to produce a satisfactory "drawing" from a negative. If there is already considerable contrast, you may be able to make the jump at once from the first "contact positive" to the enlarged negative and omit the intermediate steps.

Prizes for Best Photos of Children

THOSE readers who sent in the best photographs of children in the second of our \$100 photo contests (P. S. M., Dec. '32, p. 78) have been awarded prizes as follows:

FIRST PRIZE, \$50

John L. Doyle, Lexington, Ky.

SECOND PRIZE, \$25

J. F. Kepp, De Forest, Wis.

THIRD PRIZE, \$10

Lorraine Koch, River Edge, N.J.

FOURTH PRIZE, \$5

C. E. Fehrenbach, Ponca City, Okla.

FIFTH PRIZE, \$5

M. H. Buell, Ann Arbor, Mich.

SIXTH PRIZE, \$5

Martial L. Therbaux, Jersey City, N.J.

HONORABLE MENTION—Alfred Belagol, Jersey City, N.J.; P. H. Boyd, Ashton, Ill.; L. H. Cady, Sparta, Mich.; August J. Fry, Chicago, Ill.; Dr. H. James Greenwood, Holliston, Mass.; Marion Baller, Middleburg, Pa.; R. L. Harmon, St. Paul, Minn.; Rael Maurice, Curacao, Ill.; Mrs. August Oberlander, Hico, Texas; Thomas D. Price, Wilkinsburg, Pa.; C. A. Rad, Pittsburgh; Miss Dorothy G. Van Allen, Saratoga Springs, N.Y.; and Eula and Stanley Wertz, St. Louis, Mo.

The winners of the January contest will be announced next month.

FREE! SAMPLE CASCO WATERPROOF GLUE

It will work wonders for you as it has for thousands of other Popular Science readers. Things that would not stay glued before...now you can put them together **permanently**, in spite of moisture, heat, rough usage or plain neglect.

New Easy Method of Building and Repairing Things

Home craftsmen and amateur mechanics everywhere are discovering how CASCO Waterproof Glue, the wonder-working adhesive, makes it possible to glue things easily, quickly and **permanently**. Just as is done in big woodworking and furniture factories.

And they are amazed and intrigued to find that CASCO...a clean, non-odorous powder...mixes so quickly in cold water, forming a creamy, easy-spreading glue, makes all jobs **permanent, heat-proof and moisture-proof**.

Unlike ordinary glues and pastes which harden merely through evaporation, CASCO SETS CHEMICALLY LIKE CONCRETE. Articles glued with CASCO stay glued.

NEW JIG-SAW PUZZLE ...BULLETIN

With your sample of CASCO Glue you will receive this interesting and helpful bulletin...tells how to make your own Jig-Saw Puzzles.



Tear This Out!

Mail It Today

GOOD FOR FREE PACKAGE

THE CASEM MFG. CO. OF AMERICA, INC.
207 East 42nd Street, New York, N.Y.

Please send me, absolutely free, a sample of CASCO Waterproof GLUE.

Name: _____

Street: _____

City: _____ State: _____

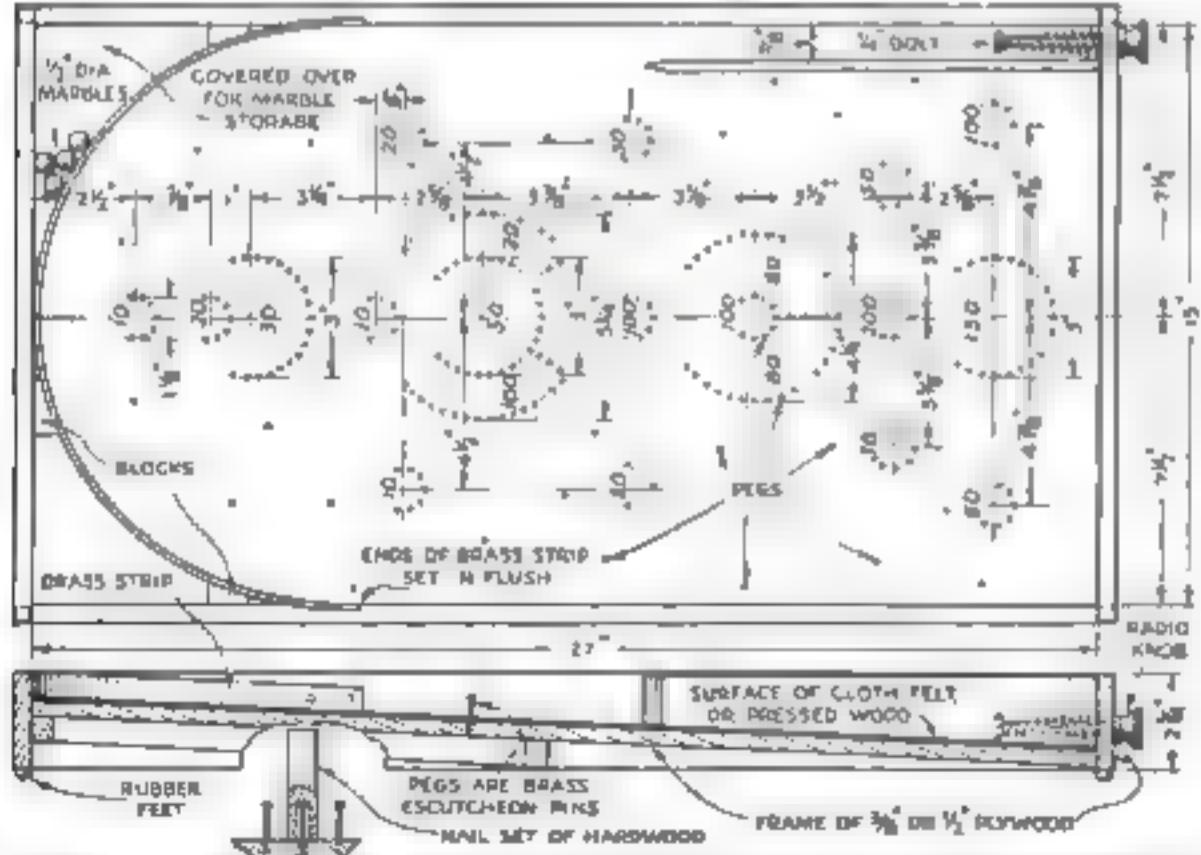
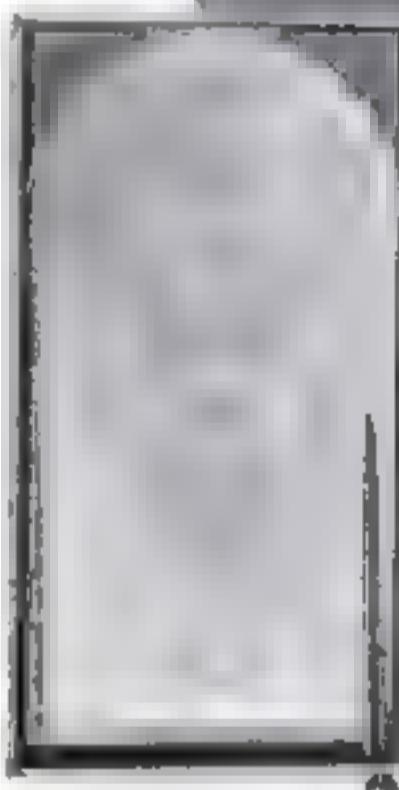
Marble Game

Is Simple to Make

MARBLE games are sold by the thousands in various designs, but you can easily and quickly make one yourself. Each player shoots ten marbles by pulling out and releasing the knob. Those marbles which come to rest in the inclosures are counted according to the numbers on the board, and the player who runs up the highest score becomes the winner.

The general construction is shown in the drawings below. The playing surface is of plywood $\frac{1}{2}$ or $\frac{3}{4}$ in. thick, or pressed wood composition board fastened to a backing of wood. The pegs or pins are either $1\frac{1}{4}$ -in. brass escutcheon pins or ordinary wire nails, and they are driven to a uniform height with a nail set made of hardwood as shown. The pins should be placed so that there are no long straight lines.

The board is set in a sloping position in its frame. The more it slopes, the livelier the game. The shooting mechanism is made from an iron bolt $\frac{3}{4}$ by $\frac{1}{4}$ in., an old radio or other knob, a spring



A plan view and sectional drawing of the game board, and a suggestion for making a hardwood nail set for driving the pins to a uniform height. By using more pins, the game can be made still "tighter."



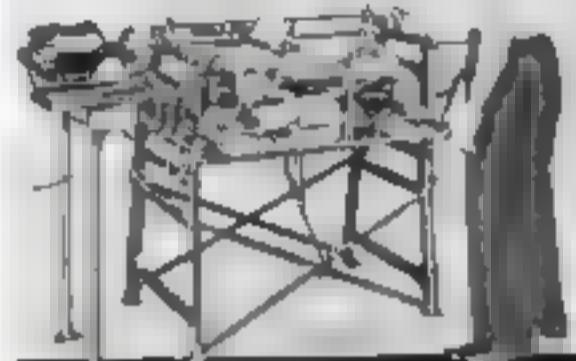
Playing the game and, at left, photo showing grouping of pins

taken from an electric heating appliance cord, an iron washer, and a rubber washer cut from an old inner tube. The opposite end of the board is closed in with a semi-regular fence bent from strip brass. The space in the corners at that end may be used for storing marbles.

An improvement is to cover the playing surface with green baize, which is invariably found on the more expensive models sold in the stores — B. G. S.

WANT A GOOD JOB?

SHARPEN LAWNMOWERS AND EARN GOOD MONEY



YOU CAN BUILD YOUR OWN PROFITABLE PERMANENT BUSINESS

Anyone who will earnestly go into the lawnmower sharpening business can make from \$40 to \$50 per week their first season. Many men have made more than this in their spare time alone. W. C. Fink, Pittsburgh, Pa., writes "I turned out 604 jobs and my standard price is and always has been \$2.00 per mower." Notes C. Rice, Rochester, N. Y., writes "I have to date sharpened 785 mowers at \$1.00 each." Wm. Seduski, Watervliet, N. Y., writes "The ideal is a wonder, no one can do a bad job on it."

The Ideal Sharpening Principle of Grinding is the Factory Method

The Ideal Sharpener is a model of simplicity. It grinds the blades of a lawnmower with surprising speed and accuracy without taking the mowers apart. It employs the same method of sharpening as used by all leading lawnmower manufacturers. Fifteen minutes work will put the average mower in perfect condition and you get from \$1.00 to \$1.50 per mower.

No Training Necessary

No training is required. Just attach the Ideal to a light truck and start to sharpen. Hundreds of dull lawnmowers are in your vicinity right now, waiting to be sharpened.

Now is the Time to Start

Start lawnmower sharpening business now. Get started early for in this business the early bird catches the worm. Write for our

**free
CATALOG**



**THE FATE-ROOT-HEATH COMPANY
331-375 Bell St., Plymouth, Ohio**

SEND ME YOUR FREE CATALOG.

Name _____

Address _____

City _____ State _____

(Please PRINT your name and address)

Secrets of Success

EMPTY GARAGE TURNED INTO PAYING LIBRARY

(Continued from page 68)

given free to each of our guests.

It worked! Every one of the fifty-three who came that day purchased something or rented a book. By August, my initial investment in books paid for itself, and soon the rental library alone began showing a net profit of about \$60.00 a month.

Now we carry a line of toys, gifts, greeting cards, games and, of course, the circulating library. While it doesn't pay much in money, it is keeping the wolf from the door, and leading us to believe that life and living are once more all they're "cracked up" to be. V. V., Stewart Manor, N. Y.

HE CASHED IN ON BOYHOOD HOBBY

ALTHOUGH I didn't know it then, as far back as the eighth grade in public school I was tinkering with a hobby that was later to become a wage earner for me. I was taking a course in woodworking that required two hours of mechanical drawing each week.



The instructor told us that neat lettering improved a drawing 30 per cent, so I resolved to become proficient in that respect. From this teacher I obtained a small lettering guide-book and the advice that this art could not be learned over night. The first alphabet that interested me was an Old English type, and my efforts at copying this alphabet looked very much like the random scribbling of a child. Naturally, I was discouraged. Yet, by patient plugging for about four months, I became fairly good at this type of lettering.

All through high school I stuck to this hobby, practising continually on such things as bookplates, mottoes and fancy decorations. After graduating I attended a technical school for two years and finally secured a job in the signal department of a large railroad.

One day I saw the diploma of a chap who had graduated from this school. His name had been lettered in Old English, and the work was poorly done. Knowing I was capable of better work myself, I went to the manager of the school and found out that they paid one dollar per diploma for this work, and that an average of 250 students were graduated from the school each year. I then submitted samples of my work and. (Continued on page 104.)

DRAW ME



COMPETE FOR AN ART SCHOLARSHIP!!

... Copy this girl and send us your drawing—perhaps you'll win A COMPLETE FEDERAL COURSE FREE! This contest is for amateurs (16 years of age or more), so if you like to draw do not hesitate to enter. Prize Awards made by the Federal Schools, Inc., will be accepted as partial payments on the regular Federal Course in Commercial Designing or Modern Illustrating.

PRIZES

1. Prizes for Five Best Drawings—FIVE COMPLETE ART COURSES FREE, including drawing outfit. (Value of each course \$185.00.)
2. All Contestants grading 70% or over will be awarded a \$25.00 credit.

No Art Scholarships will be awarded to drawings graded less than 70%, as the Federal Faculty feels the study of Commercial Art would not be justified in such cases.

The quality of instruction in the Federal Course develops your natural talent to a practical earning ability in the shortest possible time. It has been the start for many Federal Students, both men and girls, who are now commercial artists and illustrators, earning \$2,000, \$4,000 and \$5,000 yearly—some even more. The Federal Schools has won a reputation as the "School famous for successful students". Enter this contest . . . a splendid chance to test your talent. Read the rules and send your drawing to

RULES FOR CONTESTANTS

This contest open only to amateurs, 16 years old or more. Professional commercial artists and Federal Students are not eligible.

NOTE THESE RULES CAREFULLY

1. Make drawing of girl about 6 1/2 inches high, on paper 7 inches high by 5 inches wide. Draw only the girl and not the lettering.
2. Use only pencil or pen.
3. No drawings will be returned.
4. Write your name, address, age and occupation on back of drawing.
5. All drawings must be received in Minneapolis by March 25, 1933. Prizes will be awarded for drawings best in proportion and neatness by Federal Schools Faculty.

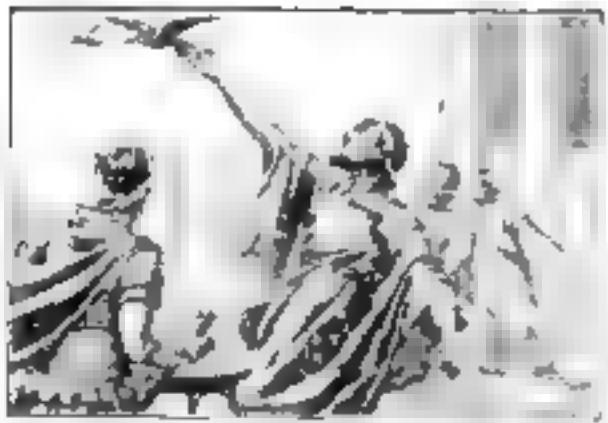
• • FEDERAL SCHOOLS, INC. • •

4143 FEDERAL SCHOOLS BUILDING, MINNEAPOLIS, MINNESOTA

This One



ZQTC-06F-45N1



INAUGURATE

The Taking of Owners

When we speak of the inauguration of a president, like us in Webster's Dictionary, we look back to ancient times when people believed in demons and looked for them on every highway. In those Latin nights went a member of the highest class of officials, in case of emergency, to where duty it was to observe and interpret the omens, such as the flight of birds at the time of an important event. This man was called a *taking of owners*, before entering upon his duty. I am certain he had no fine pronunciation of our language. From this he derived English *inaugurate*. There are a number of such stories about the origins of English words.

The "Supreme Authority"

WEBSTER'S NEW INTERNATIONAL DICTIONARY

A Merriam-Webster



Mail coupon for free booklet of "Webster's

C. A. C. MERRIAM CO., Springfield, Mass.

Please send me my free book of "How to Obtain a Patent" and full information about Webster's New International Dictionary. (Pub. Art. No. 4-32)

Name _____

Street or Box Number _____

City _____

State _____

Zip _____

Enclosed is my \$1.00 remittance.

UNIVERSITY OF PAYMENT YOUR IDEA

Write for free book, HOW TO OBTAIN A PATENT and RECORD OF INVENTION—your drawing or sketch for sending here.

MILLER & MILLER
REGISTERED PATENT ATTORNEYS

1818 Wisconsin Bldg., Dept. C, New York
205 EAGLE BUILDING WASHINGTON, D. C.
Call 4-4000 or your Free Book, or in Chicago 3-
7777, and your Record of Invention Form.

Name _____

Address _____

A Market for Your Invention

Does it exist and do you have the contacts to insure successful negotiations? Our technical staff will be happy to suggest necessary arrangements. We are interested in handling negotiations for the sale or promotion of existing business interests. Fees are nominal. For particulars, add res—Eng. Co., Eng. Co., Research and Sales Co., 103 Park Ave., New York, N. Y.

PATENTS SECURED

Trade-Marks Registered

I offer you the advantages of my 25 years experience as a patent lawyer and assure you of personal attention to your business.

TERMS REASONABLE

Book and Information Free

L. F. RANDOLPH

240 Victor Building Washington, D. C.

PREHISTORIC MONSTERS ROAR AND HISS FOR THE SOUND FILMS

(Continued from page 21)

ape dilated and grinned and the large glass eyes rolled in their sockets as six men, hidden within the recesses of the skull, turned handles to provide the necessary movement. One specialist even pumped a blood-like liquid from a tank at the base of the throat into the mouth for an added touch of realism when Koog finally vanquished his mighty antagonist.

All sounds were added after the scenes were filmed. For the anthropoid's breathing Spivack ran an old tiger sound track backward, lowering the tone an octave. This produced a low, snarly, guttural combination of growl and breath which starts low and climbs to a high peak, giving a sound entirely different from the animal sounds one hears today. The growl alone consists of a sharp bark, with the peak of a particularly loud blast used to tie the bark to a roar and a piece of breathing tied to that to tail the entire sound off into nothingness.

BUT the love notes! There were no scientific data to guide the movie makers in reproducing any of these sounds. When asked for aid in this direction, J. W. Lyle, vertebrate paleontologist of the Los Angeles Museum, replied, "For the dinosaurs I would suggest that you reproduce various degrees of hissing sounds and for the mammals an admixture of grunts and groans."

As anyone knows, not even a wild animal makes love by growling and hissing. So Spivack stepped before the microphone with only a megaphone to utter deep "r-r-r-ump," "r-r-r-ump," "r-r-r-ump" in long and short grunts, thereby establishing for all time the love call of the prehistoric ape.

The tyrannosaurus—the largest animal ever known to exist—sixty feet long and with a three-foot skull—hisses and roars his vocal contributions to the battles and his mythical contact with man. But these two sounds, when produced with the necessary low tones, offered too little contrast.

During a battle with the ape, the voices of the two animals not only must be distinct, but the latter must blend. That was a pose! As the scene developed on the projection room screen, I heard what sounded remotely like the hroing of strata and a panther's purr.

Spivack had mixed an old panther sound track with the stealth-like noise from a compressed air machine and added a few screeches from his own throat, uttered a few inches from a microphone in the soundproof room. Exactly in what proportions they were blended I cannot say, for each sequence demands many trials before the two noises come through the loud speaker in such volume and of such quality that the small audience of men expert in diagnosing sound declare, "Kong and the Tyrannosaurus must have sounded like that."

NOW the brontosaurus, one of the best known of the prehistoric quadrupeds, once lived in the Wyoming-Colorado region. Little did he think that one day his guttural croaks and bisses would reach the movie screen. But Elliot has gone the anthropologists one better, not only does he declare the brontosaurus croaked and bissed, but with dramatic license he inserts one croak after every four bisses.

The triceratops resembles an enlarged boar or a rhinoceros, more like a boar, perhaps, because of the three large horns protruding from his head. This little fellow measures only twenty-five feet long, yet in the picture he bellows like a bull, gored a man and tossed him into some long-forgotten bush—to the

accompaniment of a reversed and lengthened elephant roar.

Some of the miscellaneous sounds were created with the simple instruments one would find in any studio sound laboratory. One hour Elliot was grunting into a hollow double gourd with a microphone conveniently placed to pick up deep growls and grunts of the triceratops, later in the morning he was half-reclined on the floor, grunting through a water-filled mouth into a megaphone, thus producing the animal's death gurgle.

When Koog went prowling down a river bed, Spivack squatted close by the ever-present mike, pounding with two enlarged plumbers' friends on a gravel-filled pad.

FOR two years the movie makers have had this fantastic picture in preparation. Technically, it has proved the most difficult idea to put into a motion picture that has ever been attempted. Readers of POPULAR SCIENCE MONTHLY already are familiar with the technique of animating mechanical animals for the movies. For such pictures only one-sixteenth of a foot of film can be exposed on a given scene and never more than twenty feet may be completed during a working day.

Many of the scenes, particularly that in which the ape fights a squadron of pursuit planes while straddling the tower of the Empire State Building, are made up of four distinct shots merged into a composite timed to a split second. The mechanical monsters move with apparent ease, but each was created on skeletons of metal duplicating those to be seen in various museums.

But the problem was only half solved with perfect animation. In order to reproduce the ape's jaw movements, as the six men hidden inside the massive head operated levers controlling the movements, it was necessary to expose 238 frames, each measuring one-sixteenth of an inch.

It would have been impossible a few years ago to film such a story. It might have been told in the form of drawings, yet the movies would not have touched the weird tale. But the technical growth of motion pictures is astounding.

As the sound in King Kong demonstrates, the rapid development of electrical recording equipment during the last two years has made obsolete many devices previously used in making synthetic noises for talking pictures. Fully three-fourths of these sound effects instruments have been discarded during the last year.

SOME mechanically-produced noises sound more like the genuine sound than the original itself. One of these is wind. Another is thunder. Thunder is so expensive to record, so many takes being required at different times and locations to record one peal successfully, that most of the thunder you hear is synthetic.

But the majority of animal sounds you hear are natural. Their recording is made possible through use of an immense electric ear, as large as a door, which picks up distant sounds and concentrates them at a small microphone placed in the center. This giant ear is able to hear hoof-beats before they become audible to the human ear, record them as their volume builds up and permit them to fade naturally into the distance as the horse comes by.

Frequently natural noises are mixed, several sound tracks being run simultaneously in order to re-record them on a single track. With these, many tricks may be played, such as running one backward, another forward at an accelerated speed, or lowering the tone an octave. Some of the results would chill your backbone were you to hear them at night.

HOME GLOW LAMPS TURN NIGHT INTO DAY

(Continued from page 41)

to 15,000 volts required until recently for all neon tubes would be impractical and even dangerous in the home. The new lamps must fit standard sockets and work from conventional outlets, since most householders could not be expected to re-wire their present dwellings or install special fixtures. Glow lamps must give the proper type of light for the home. White light, most difficult of all to obtain in a glow lamp, must be available.

REPORTS began trickling in from various parts of the country, not long ago, that engineers were conquering these problems.

Experimenters in a Seattle, Wash., laboratory announced they had been able to obtain a soft, white light from a glow lamp of special construction, containing carbon dioxide gas and operating successfully on household voltages. They built a crude model of a table lamp using the new light; its luminous source was a double row of tubular fingers, extending like the teeth of a rake from a pair of main tubes.

Meanwhile engineers in the research laboratories of the General Electric Company were developing a glow lamp that employed the luminescence of hot sodium vapor with amazing efficiency. The brilliant yellow color of this lamp is unsuited for reading or similar purposes in the home, but it promises an abundance of cheap light wherever color is not important. When a one-mile test strip of a motor highway in Holland was recently lit with daylight brilliance by similar lamps of European manufacture, motorists turned off their headlights unasked and found that they could speed at a mile-a-minute rate in safety and comfort.

It remained for a young electrical engineer of Berlin, Germany, Dr. Hans Joachim Spanner, to create a household glow lamp of such compact and simple construction that it may be manufactured at an estimated cost of only three times as much as an incandescent bulb. The initial cost is no drawback, for the new tube is said to give three times as much light as an ordinary bulb of similar wattage. This was the lamp demonstrated in New York the other day by the inventor's brother, Dr. Gerhard Spanner, research chemist of the Columbia University Medical Center.

The candle-shaped bulb works on household voltages and will emit light of any desired color. White light is obtained from a single tube by a mixture of mercury, cadmium, zinc and sodium vapors in a proportion worked out by the inventor. The lamp may also be designed to emit ultra-violet rays.

ONE of the technical problems of constructing a glow lamp for low voltage—the difficulty of making it self-starting or able to light itself without an initial application of high-voltage current—is ingeniously met by the new lamp's special design. Although the main part of the current flows between widely separated electrodes at top and bottom, an auxiliary electrode is embedded in the glass wall near the top. It serves to ionize or activate a small quantity of argon gas within the tube, which has the property of glowing readily. The argon gas acts as a self-starter, exciting the other vapors in the tube and preparing a path for the current to flow between the main electrodes. To keep the lamp from drawing too much current, or "running away," as electrical men say, a small device known as a choke coil is built into the screw base.

Whether the glow lamp of commerce will take this or some other form when it makes its bow to the public will be decided by the relative success of the independent experimenters now at work.

PATENTS and TRADEMARKS

FREE BOOK

Mail Coupon NOW

Record of Invention

This Book Tells

How to Obtain a PATENT

ALSO FREE

"Record of Invention" Blanks: On request I will send you FREE a copy of my "Record of Invention" blank. On this blank you can sketch and describe your invention and have it witnessed in such manner that it may be of value to you as evidence. Send coupon now and receive this form together with my free book.

CLARENCE A. O'BRIEN
REGISTERED PATENT ATTORNEY
WASHINGTON, D. C.

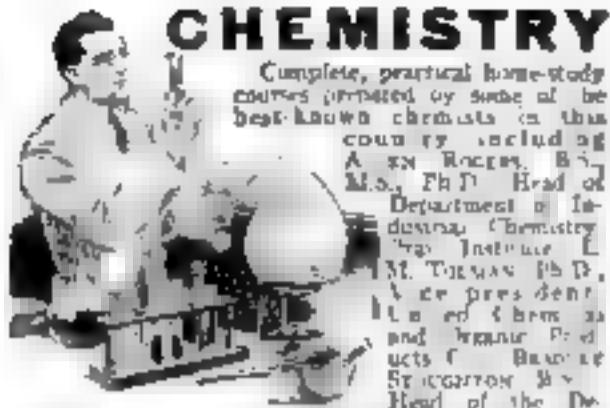
Clarence A. O'Brien
Registered Patent Attorney
60-W Adams Building, Washington, D. C.

Please send me your Free Book, "How to Obtain a Patent," and your "Record of Invention" form, without any cost or obligation on my part.

NAME _____

ADDRESS _____

(Important: Write or print name plainly.)



CHEMISTRY

Complete, practical home-study courses prepared by some of the best-known chemists in this country, including A. J. R. Rogers, B. M. F. D., Head of Department of Industrial Chemistry, Royal Institute; E. M. Tolson, Ph.D., Vice President of the Royal Society of Chemistry; and Maurice P. L. St. Croix, B.Sc., Head of the Department of Metallurgy, Lehigh University; and Queen L. S. S. Ph.D., Professor of Applied Chemistry, University of Pennsylvania.

Mail Coupon for Free Booklet

INTERNATIONAL SCHOOL OF CHEMISTRY

President of the International Correspondence Schools, Box 7442-B, Scranton, Penn.

We know you will be interested in the following courses:

- Analytical Chemistry
- Agricultural Chemistry
- Chemical Engineering
- Industrial Chemistry
- Short Chemistry Course
- Pharmacy

Name _____

Address _____

PATENTS—TRADE MARKS

All cases submitted given personal attention by members of the firm.

Information and Booklet Free

LANCASTER, ALLWINE & ROMMEL

PATENT LAW OFFICES

One International Bldg., Washington, D. C.

New Ideas now Salable Before Patenting

Information for

Chartered Institute of American Inventors
1010 16th Street, N.W., Washington, D.C.

PHOTOGRAPHY IS your OPPORTUNITY

McGraw-Hill Publishing Company, Inc.
New York Institute of Photography

Inventions Promoted

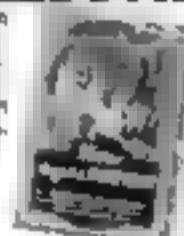
Patented or Unpatented. In business over 20 years. Send drawing and description or model or write for information. Complete facts free. References.

ADAM FISHER MFG. CO.
183-D Enright, St. Louis, Mo.

INVENTORS PATENT YOUR IDEAS

Get this FREE Book

The future profits from your idea by securing a U. S. Patent. Drawings are often dangerous to give prompt and permanent attention to your design. It is necessary to understand what rights are being given. The cost of filing a patent application is not a burden in order to protect your invention. The date before doing anything else, contact the U. S. Patent Office and file your application. It is available FREE. Send us a brief description of your invention. We'll help you.



L. EDWARD FLANERY
REGISTERED PATENT ATTORNEY

710 International Building, WASH. MOTOR, D. C.
Send a few paragraphs of your FREE book and we'll send
you a copy of our book.

Name _____

Address _____

City _____ State _____

SWIFT MOTOR TRUCKS PUT AMERICAN CIRCUS BACK ON ROADS

(Continued from page 37)

everything is torn down and packed, all hands go to sleep in bungalow cars equipped with lavatories, clothes presses, and radios, or in private tents if they prefer them to house cars.

I know from experience that sleeping on the lot is much more restful than in Pullmans where two in a berth and two berths high is the trouper rule, except for stars or executives. I have trudged many weary miles through dark, strange streets hunting the train after the night show and have lost many an hour of sleep looking for my Pullman in railroad yards. Last season a truck circus made my summer home town in Connecticut. After the night show some of the band boys dropped in to see me. When we reached the lot an hour later all lights were out and all the troupers were asleep.

UP EARLY in the morning for a hearty cook-house breakfast, all hands are away soon after daylight in their modern circus caravan. All hands includes the riding elephants, horses, and ponies. At the rear of this colorful procession is the service car. If a car is stalled, its load is hurried to the next stand by the service car, which then returns and repairs the stalled car.

Most of these motorized circuses move as rapidly as railroad shows. The Donnie Bros. Three Ring Wild Animal Circus, for example, opened last season at Atlanta, Ga., April 20 and 21; showed Louisville, Ky., April 28 and 29, and pitched its tents at Akron, Ohio, May 9 and Canton, Ohio, May 10. Dill's Circus opened at Texarkana, Tex., April 16, exhibited at Little Rock, Ark., a few days later and at Memphis, Tenn., April 21. Barnett Bros. Circus toured North Carolina, Tennessee, and Kentucky during April and was in Indiana and Ohio the first half of May. Our good roads program has helped truck showmen solve their transportation problems.

According to H. S. Fairbank, director of publications and information for the United States Bureau of Public Roads, the mileage of hard surfaced roads in this country is now in excess of 467,300 miles.

Although a few states have recently enacted laws which require motor trucks and passenger cars to take out local state licenses when entering these states, more than thirty states grant full reciprocity, while other states have set a time limit within which circuses can exhibit without taking out local licenses for their motorized equipment.

TEXAS has recently enacted a law that makes the license cost for motor trucks almost prohibitive. This state has also fixed 20,000 pounds as the maximum gross load weight of any vehicle on four wheels; eight feet as the maximum load width, excepting for farm tractors; twelve feet as the maximum height; thirty-five feet as the maximum vehicle length; forty-five feet as the maximum length for truck and trailer; 650 pounds as the limit per inch of tire width concentrated on the road surface; and 15,000 pounds as the load limit on any axle. Owners of motorized circuses are building equipment to meet local regulations or are avoiding states in which there are such unusual laws.

Loss of circus exhibition causes local losses. During three weeks in Montana, one motorized circus bought 6,000 gallons of gasoline, 100 gallons of oil, paid \$1,800 for local licenses, \$1,200 for local advertising, and \$1,500 for perishable food. Thus you see it is not all profit in the circus business but vast sums of money are left behind in the various towns.

as the show moves on to the next lot.

Motorized circus owners are shrewd and thrifty managers. They have worked out many ways of saving time and money. For example, they cover their wild animal cages with canvas tarpaulins during their journeys from town to town. Once on the lot these tarpaulins are dropped, and the cages are open for townsmen's inspection during the grand street parade.

Also for the parade, the sides of many baggage trucks disappear and gaily spangled circus men and women appear on red and gold floats, all in accordance with circus tradition. As for the horse and pony trucks, when they reach the lot the tail board is dropped, and down this gangplank come the animals, much as they used to come out of railroad stock cars.

MOTORIZED circus owners have displayed acumen in saving money formerly spent in buying wares and other kinds of expensive and useless equipment. In the golden age of railroad circuses, government Wards were annually popular. Opposition paper was covered by rival billposting agents who often resorted to fist fights and worse. When John Ringling became the overlord of railroad circuses, billposting fights were no longer necessary. His shows are routed to avoid competing with each other.

Troupers take to motorized circus because it is gypsying in the modern manner and at heart all troupers are gypsies. Driving circus trucks or passenger cars is just one part of a happy day. They make a game of watching for the circles, arrows, and other marks chalked on roadside telephone poles and post to guide their caravan from stand to stand—for the road is ruled, that is, marked, with chalk these days.

This gypsying in the modern manner is high adventure for most troupers. Though an all night pack up jump is sometimes necessary, and members of the circus company must catch up with their sleep between performances, these inconveniences have the troupe in good spirits.

Big circuses must always travel by rail. Whole fleets of trucks could not transport them. Yet John Ringling has only four of his amusement institutions on the rails this year—the Ringling Bros. and Barnum & Bailey, which moves a hundred miles or more each night on its ninety steel cars; seventy or eighty feet in length, the Hagenbeck-Wallace, on thirty-five cars, and the Al G. Barnes and Sells Floto on thirty cars, each. This arrangement leaves more room, more towns of good size, for the modern, motorized circus caravan.

THE ever increasing number of these Twentieth Century circuses play over familiar routes to jam fair audiences in towns and cities of from 500 to 15,000 population. Primarily they serve rural communities, hence they become family affairs for professionals as well as townpeople. During many years prior to her recent demise, Mollie Bailey's Circus made the same towns in Texas and annually gathered paving patronage by merely announcing in post offices and stores that "Aunt Mollie's Coming."

Thanks to the advent of automobiles, motor trucks, and trailers, the circus, which had its beginning in America under the patronage of President George Washington and has been delighting American children of all ages for two centuries, has come back to the country road of our fathers and is annually brightening the lives of townfolk and villagers.

COLLOID EXPERIMENTS FOR HOME CHEMIST

(Continued from page 57)

When the gelatin has set, pour some silver nitrate solution on top of the gel. In several days beautiful stripes of color will appear. These colors are formed by the silver dichromate that is precipitated.

In a similar way, blocks of dichromated-gelatin placed in a solution of silver nitrate for several days and then sliced will be found to be banded in colors.

A strange characteristic of all solutions, both true and colloidal, makes possible a novel experiment that can be performed with simple homemade apparatus. When a substance like sugar is placed in water, it distributes itself through the liquid by what is known as its solution or osmotic pressure.

All that is required to demonstrate the osmotic pressure of a solution is an olive bottle with its bottom removed, a sheet of cellophane, and a length of glass tubing fitted with a rubber or cork stopper.

PLACE the square of cellophane across the open bottom of the olive bottle and fasten it in place like a drum head with rubber bands or string. Several coats of shellac or spar varnish along the edges will serve to make the cellophane membrane air tight.

Fill the bottle with a strong solution of sugar in water, fit the stopper having the glass tube extending through it into the neck of the bottle, and place the bottle in a container of water.

After some time it will be noticed that the solution in the bottle is rising in the overflow tube. Sometimes the solution will rise as much as a half inch an hour and, if the glass tube is not too long, it will eventually overflow from the top.

Obviously, some force is at work which increases the volume of the sugar solution and forces it up the overflow pipe. This force is the solution or osmotic pressure.

It so happens that the membrane of cellophane over the bottom of the bottle tends to absorb water from the sugar solution and also from the outside body of water. However, the sugar dissolved in the sugar solution prevents any great amount of water from passing outward through the membrane. The outside water, on the other hand, contains no dissolved substance, and is passed through the membrane without much difficulty. As a result water leaves the outer vessel or container and enters the olive bottle, decreasing the concentration of the sugar solution and increasing its volume.

In this experiment, the exchange will always be from the dilute to the more concentrated solution. Although woods tend to show this same characteristic they do so in a very small degree as compared with true solutions.

OSMOSIS is responsible for the formation of the magic chemical garden described previously (P&M July '32, p. 61). As each chemical crystal is dropped into the water glass solution it forms a membrane-like precipitate about itself. The water in the water glass solution passes through these silicate membranes and dilutes and swells up the chemical remaining inside. This continues until an equilibrium of pressure is obtained.

This peculiar growth, due to the swelling of a chemical, can be studied closely by allowing a drop of strong potassium ferrocyanide solution to fall into a beaker of weak copper sulphate solution. The globular drop becomes coated with a brown skin.

The coating forms a membrane and due to osmosis the drop gradually swells up in size. If the copper sulphate is not too weak, the drop will rise slowly and then sink. A similar growth is obtained by squirting ferrocyanide solution into copper sulphate solution.

Delays May Be Costly **PATENT** Your Idea Now!

Little Ideas May Have Big Commercial Possibilities

**Don't Lose Time—Send
For Big FREE BOOK**

ACT AT ONCE—and today is the day. Remember to get the details of your idea down on paper before you have to file. Many men spend years perfecting an invention, only to find that someone else thinking along the same lines has already received a patent on the idea. When we think of all such cases, however, we often forget that it costs only \$15.00 to obtain a U.S. PATENT. This is only a few dollars to pay for a lifetime of rights which may not lose all their benefits if you hard work in planning and perfecting your invention.

**Mail the Coupon for
FREE Book Today**

How of tremendous importance that you file your application for a patent as soon as possible. This free book tells you how to do this, what is needed, how often you must do general and specific drawings, and a sample of what we also send you. Remember to file as quickly as possible. Don't wait, sending your patent now. Mail the coupon at once. Enclosed along a sketch and description of your invention we will promptly write out what an outstanding claim to be done in order to protect it and to which extent there will be no chance.

**Highest References—Strikingly Secure
33 Years of Proven Service**

The members of the firm of Victor J. Evans & Co., are specialists in the law of patents and trademarks. We have been in the Patent Office and before the Courts for many years, and have a knowledge of the law and practice of the office which is unequalled. We have a full staff of attorneys, patent examiners, and clerks, all of whom are thoroughly qualified to handle any case. We are a full-service office, and our services are available to help you get the best results. We represent in the U. S. Patent Office and in foreign countries.

Here's How We Operate

From the Department of State in Washington, D. C., we receive all the information concerning patent applications, and from the Patent Office we receive all the information concerning the examination and filing of patent applications. We have a full staff of patent examiners, and our work is done in a thorough and painstaking manner. Our clients are given the best possible service, and we are always ready to help them in any way we can. We represent in the U. S. Patent Office and in foreign countries.

Here's What the Coupon Brings. Mail It Now

Mail the coupon right and take the first step toward the U. S. Patent Office. Be sure of your rights, and get information on paper. You are the designer of your idea, but the law is the one who decides what you can do with it. Please mail the coupon now. Your name is the only information we require.

**MAIL
THIS
TODAY**

**FREE . . .
VALUABLE RECORD
OF INVENTION BLANK**

Mail the coupon today, and in addition to the "Record of Invention Blank" you will receive a copy of "How to Obtain a Patent," a valuable booklet containing valuable information on the subject.

**HOW TO OBTAIN A
PATENT**



**VICTOR J. EVANS, & CO.
Established 1898
REGISTERED PATENT ATTORNEYS**

MAIN OFFICE: 1640 DD Victor Building, Washington, D. C.

**BRANCH OFFICES: 1640 DD Conway Building, Chicago, Ill.;
Broadway, New York; 128 DD Fidelity Trust Building,
Philadelphia; 54 DD Empire Building, Pittsburgh; 1000 11th Street,
San Francisco.**

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention Blank."

Name _____

Street and No. _____

City _____

State _____

Get A FLYING START TO SUCCESS IN AVIATION!



With the
Greatest Guide Book
Ever Published

THE AVIATION MANUAL

This book will save months of time and hundreds of dollars by giving you a thorough ground training in Aviation. You need it whether you're going to be a pilot, mechanic, sales agent or salesman or executive. The book is standard in its 716 pages and \$3.95 retail, and our franchises can assure you that while held in inventory, it will always be a reliable reference work even long after you've finished your preliminary work.

LOOK AT THIS LIST OF 24 FULL CHAPTERS

all by leading
authorities

All Covered in Full Detail

Opportunities in Aviation—The Business of Flying—License Requirements—Qualifications for Flying—Training To Be an Aviator—Your Background of Knowledge—Aviation Schools and Their Courses—How to Get the Best in Flying—Course—Your First Flight—Start of Airplanes—Seaplanes and Amphibians—The Construction of New Power Plants—The Manufacture of Engines—Instruments—Elementary Aeroplane Design—Materials and Their Properties—Wines and Liquors—Wood and Metal—How a Pilot Inspires His Plane—Learning to Fly—Advanced Flying—Taking an Air Course—Air Traffic—The Law—A Note on The Aviation Manual is edited by Lieut. Comptroller John W. Tamm, U. S. N. R. He has over 3,000 flying hours to his credit and is now commanding officer of Squadron A, 3rd of the U. S. Naval Reserve. Many of his former student officers are now holding important positions in the Aviation Industry as pilots and executives.

**REGULAR PRICE \$5.00—
NOW ONLY \$3.95**

With Your Name In Gold On The Front Cover

Now you may have this beautiful Manual bound in elegant flexible leather with gold edges and gold corners. It is a sturdy book and will not easily fall apart in cold weather. The leather is very temperature proof which may be with rain or snow. The leather is impervious to water. The book is well bound and when you are disappointed, you can make a return if you like.

Popular Science Publishing Co.,

301 Fourth Avenue, New York, N. Y.

Please send me a copy of the regular \$5 edition of the Aviation Manual with full gold edges and my name in gold on the front cover and the leather all impervious to water. Please pay \$3.95 for the Manual. If I am dissatisfied I may return the book within ten days and you will refund my money.

Name _____

City _____ State _____

Address _____

DOWN A ROPE INSIDE A VOLCANO

(Continued from page 13)

gathering samples of gases and minerals, studying the un-seeable sights around the abd snapshot pictures with my camera.

Sensing exhaustion near I gave my friends the prearranged signs with the hand signal to haul me out. The agent was painful beyond words. My will stretched to the breaking point deserted me. The oxygen reserve was exhausted and I was forced to breathe air charged with the sulphurous fumes. As I was dragged over the crater's edge into fresh air my over-taxed lungs gave way and I suffered a severe hemorrhage.

When I recovered, I felt infinitely calm. After so much effort, so much nervous strain, I was happy that I had succeeded in an enterprise thought impossible by every one.

SOME time later, accompanied by my friend Paul Muster, I had another thrilling adventure on the flank of this same volcano.

On one side is a slope, a gigantic inclined plane of cinders more than half a mile wide, known as the "Scara del Fuoco." Down it rocks and slag and enormous blocks of lava roll and bound toward the sea.

No one approaches this slope. Ships that circle the island keep at a safe distance. Nevertheless, Muster and I prepared to make the ascent with motion picture cameras. For the purpose, I had prepared two suits of sheet-steel armor. They would not, of course, protect us from the great blocks of lava, but they would shield us from the small rocks which often fell in showers.

We began the climb. After hours of painful effort, we reached a spot where we could set up our cameras to take pictures of the rocks being hurled from the fiery crater.

With our films exhausted, we prepared to descend the slope again. An immense block

of lava set deep in the cinders, some distance from the top, gave us temporary shelter. Then Muster observed a black rock, fifty feet away, that interested him.

LEAVING our shelter, he lay flat on his stomach and wriggled toward the immense cinder. As I was watching his slow advance, admiring his courage, I heard a great clamor rising from the edge of the sea I sprung about. Our friends at the foot of the mountain were crying with terror and running toward the crater. I looked up just in time to see a gigantic rock detach itself, describe an immense arc through the air, strike the cinders, throwing them up like an explosion, and bounce again into the air. Horrified, I saw it was headed straight for us.

It fell again and again. Then, with an infernal roar, it roared forty feet over our heads. The rush of air threw us down.

Hardly had we time to take breath when new trouble assailed us. Stung by the successive shocks, the bed of cinders, slag, and stones covering the flank of the volcano was beginning to move. Great masses detached themselves, came sliding toward us.

Without consulting, Muster and I instantly arrived at the same idea. With a single motion, we divested ourselves of our armor, which we allowed to roll down the slope. Then abandoning ourselves to the laws of gravity, we followed in their wake.

How long that helter-skelter, breakneck slide continued I do not know. By some miracle we neither broke our backs nor fractured our skulls. Torn by jagged cinders and covered with blood, we reached the foot of the volcano. Here our friends took us in hand, dressed our wounds, and congratulated us upon our escape.

LEARN THE STARS WITH AN UMBRELLA

(Continued from page 13)

you can do with your star-marked umbrella.

Turn the umbrella top downward, below the table top, holding the rod at the same slant. Look downward along the rod. You are now viewing the southern half of the sky, with the South Pole of the heavens at its center. Note the famous group called the Southern Cross; the southern polestar is a small one, called Sictus Octantis.

Now rotate the handle of the umbrella in the same direction you did before, from the eastern horizon of the table over toward the western, and watch the stars inside the umbrella. You will be surprised to see that the southern stars travel around their pole with the hands of a watch instead of against it. In other words, the stars around the southern pole rise at your left instead of at your right as they do in the northern sky.

Now for a few words about the sixteen principal stars around the North Pole, which

you have put down as white dots on your umbrella.

You have of course recognized the star group of seven which is the big dipper. You probably know that a line through the two pointers is the side of the dipper away from the handle points out the polestar. The group of five forming a sprawling "M" or "W" just opposite, across the pole from the dipper, is the constellation Cassiopeia.

Now draw a line at right angles to the line through the pointers and the polestar. At one end of the line are two stars, at the other, one. The single star, as we have already seen, is Vega. The two opposite it are in the constellation Altair, or the Charioteer. The brighter of the two shown by a larger dot is Capella.

The next article will show you an interesting way to use these stars around the pole in telling the time at any season of the year, within a few minutes of watch accuracy.

THIS series of articles will give you a new and highly illuminating idea of astronomy. The author, who has written two decidedly successful books on the subject, will give you practical suggestions for star study that can be carried out with homemade tools put together with odds and ends and not requiring heavy outlay for telescopes or other equipment. Doubtless the article this month will inspire many readers to make star trail photos and to encourage a friendly competition. Popular Science Monthly will give a prize of ten dollars for the best star trail picture sent to the editor of the Department of Astronomy, in care of this magazine, 301 Fourth Avenue, New York City, on or before April 30, 1933.

STORM CARRIES GOLD

GOLD and silver fell from the clouds recently in Los Angeles, Calif. A wind-storm, sweeping in from the desert, deposited more than a million tons of dust on the city,

the City Engineer's office estimated from samples taken. A veteran assayer of the city, John Hermann, swept up some of the dust and tested it in his laboratory. His laboratory test showed minute particles of gold and silver.

CHOOSE SPARK PLUGS TO FIT YOUR CAR

(Continued from page 64)

out for sure by taking them to a good service station," said Gus. "Or you can check them for short circuits yourself if you want to. Run your motor and then short-circuit each plug in turn with a screw driver or a hammer head. If cutting out a plug doesn't make the motor run slower, you can bet there's something wrong with that plug. When a good plug is shorted, the motor will slow down."

"Why not unscrew the plug and test it on the cylinder head?" Joe asked. "You can see it spark then, and don't have to rely on your ear."

"Even if it did spark, that wouldn't prove much," declared Gus. "Just because a plug sparks out in the air is no guarantee that it'll work inside a cylinder. You've got compression inside a motor and that makes it harder for the spark to jump."

"Well," smiled Hardy, "I guess the biggest trouble I have with spark plugs is taking them out without skinning my knuckles."

"THEY come out easier sometimes if you run the motor to heat it up," Gus told him. "The best way, though, is to smear a little graphite grease on the threads when you screw them in. Never screw in new plugs when the motor is hot. The head cools and contracts like a vise around the cold plugs. Well, that's about all there is to the spark-plug story," finished Gus with a grin, "but if you'll come into the shop with me, I'll show you a few other things you can do to your car while you're about it."

Gus led the way to the back of the repair shop and the two men followed him.

"Say, that looks great!" Hardy exclaimed as Gus lifted the hood on a small roadster. "Painted the motor, didn't you? I never thought of doing that. What kind of paint did you use?"

"Regular motor paint," replied Gus. "You can buy it at any automobile supply store. I think the mail order houses carry it also."

"But why paint the exhaust manifold?" Hardy asked. "That paint won't last very long, will it?"

Gus chuckled. "It wouldn't last very long if it was paint, but that black coating happens to be stove polish. I just smeared it on and rubbed it in."

"By the way," he added, digging into the back pocket of his overalls and producing a well-thumbed notebook, "sometime ago I saw a formula for motor paint and I think I made a note of it."

"Yep, here it is. Take eight ounces of white lead in oil and mix it with six ounces of boiled linseed, two ounces of turpentine, and a half an ounce of lamp black. That'll give you enough gray paint for six cylinders."

"IS THERE much to this business of choosing spark plugs to suit a motor?" Joe asked after Hardy had gone.

"I'll say there is," asserted Gus positively. "Two cars can be the same when they leave the factory but if one is bought by a young salesman and the other by an old maid, those two cars will be as different as day and night after a year."

"The salesman, probably, will be a speed demon and most likely have trouble with overheating and pre-ignition. The woman will use the car for shopping and she'll probably have trouble with fouled spark plugs. The right kind of spark plug will help each motor."

"More than that, the day's coming pretty soon when we'll be fitting a different type of plug to each cylinder. Instead of giving a man six or eight plugs all alike, we'll test his car and put in the kind of plug the motor actually needs, with no guesswork at all."

WIN THIS BICYCLE

BOYS! Here's your chance to win a 1933 deluxe model motorbike—without a cent of cost. Comes fully equipped. Fleet as the wind. Easy riding. Besides, you can win your choice of 300 other prizes and earn CASH PROFITS. It's easy. Deliver 3 well-known magazines to customers in your neighborhood. Will not interfere with school or play. Write NOW—and we'll start you.

Get These Prizes Without Cost!



MAIL THIS COUPON→

Mr. Jim Thayer, Dept. 303
The Crowell Publishing Co.
Springfield, Ohio

Dear Jim: I want to earn MONEY and PRIZES. Start me as a subscriber.

Name _____

Address _____

City _____ State _____

OUR PRICES ARE LOWEST FOR VENEERS

Twenty samples, 4" x 9" of foreign cabinet wood veneers for \$2., with instructions giving full particulars on how to lay veneers, glue inlays, borders and fancy woods. Special attention given to Household and school orders. Also send for our free price list. In business for 120 years, reliable.

ALBERT CONSTANTINE & SON, INC.,
778 E. 149th Street,
New York City

How To Make Better JIG SAW PUZZLES

New book gives latest methods in puzzle making that add extra interest to puzzles. Tell us to cash in on JIG SAW PUZZLES, the big new diversion now sweeping the country. Send for a copy or stamp to cover cost of mailing.

J. D. WALLACE & CO.,
Wabash and California Ave.,
Chicago, Illinois

EARN \$60 A MONTH AT HOME!

Send EASY TO TYPE
"How To Make
JIG SAW PUZZLES"
and
"CUT
Woodworking
Equipment
for Less Than
\$100.00".
TO EARN a few minutes a day, follow simple
instructions. You'll earn
\$60.00 a month. \$100.00
investment. Each
month you'll receive
with cost of a typewriter
and paper, the latest information
on how to make puzzles
and how to sell them. Order
now. Write today. No obligation.
J. D. WALLACE & CO., 1111 N. Dearborn
Bldg., Chicago, Illinois.

POWERFUL MICROSCOPE

See Advertising New World Right Under Your Nose
This Store Specializes in Books on Home
Woodworking Equipment
and other hobbies
and interests.
Write and obtain
our catalog.
JUNIOR LAB INSTRUMENTS
Supplies 4000 Users Barber Area
Not a day passes without
a new invention
or improvement.
Hobbies and sports
are more popular
than ever before.
Order
from
J. D. WALLACE & CO., 1111 N. Dearborn
Bldg., Chicago, Illinois.

IT'S EASY TO MAKE BIG SPARE TIME MONEY

Send for our free plan on how to make \$5.00 to \$10.00 a week in your spare time by taking orders for Picture Service Money from your friends. No writing required. Turn extra hours into extra dollars.

POPULAR SCIENCE MONTHLY
204 Fourth Ave., New York, N. Y.

Print Your Own

Cards, Stationery, Advertising, labels, paper, circulaires, tags, etc. Save money and time. Sold direct from factory only. Junior Press \$2.50, Job Press \$11. Power Press \$25.00. Job printing like newspaper printing with just 1¢ per page. Print for others, big profits. Pays for itself in a short time. Easy rules sent. Write for free catalog of outfit and all details. The Kelsey Co., 8-13 Market, Green-

OWN A CARAMEL POP-CORN STORE

Make quick success with CARMEL CRISP—sensational new candied Pop Cornvention. Simple, inexpensive. Occupies in many rooms. Little capital. No special tools required. Large profits. Immediate franchise. Large profits from first day. Minimum strength of Franchise \$100. Write today. No obligation. LONG-BAKING CO., Originators of High Street, Springfield, Ohio

CIVIL SERVICE

VALUABLE INFORMATION FREE

Columbian Correspondence College,
Washington, D. C.

High School Course in 2 Years

Study of two years. Meets all requirements for entrance to college and the leading professions. This new correspondence school course is described in our Free Bulletin. Read it today.

AMERICAN SCHOOL

Dept. H-144 Division St. & Mifflin St. A. B. TUCK, CHICAGO

Learn to MOUNT BIRDS

By an expert Taxidermist. We teach you at home by mail. All equipment, brushes, brushes, skins, needles, etc. Also mounting animals, squirrels, rabbits, frogs and insects. Our services in spare time. **FREE BOOK**. Tell all about birds. How to have a wonderful hobby and how to turn your spare time into bird profits. Price, \$1.00. Send today. Bird Age, P. O. Box 1000, Cedar Bluff, Omaha, Neb.

U. S. Government Jobs

RAILWAY POSTAL CLERKS

(City and Rural)

\$1700 to \$3400 Year—

MEN—BOYS, 17 UP SHOULD MAIL COUPON IMMEDIATELY

Many future appointments



FRANKLIN INSTITUTE

Dept. H-273, Lancaster, N. Y.
Send back to me WITHOUT CHARGE FIVE
copy books and list of sample U. S. Government
positions and tell me how to get a
new U. S. Government position.

Country
Name
Address

Clues Tell Secret of Man's Ancient Life

(Continued from page 15)

drinking mead. The old beer horn contained starch and protein cells from an ancient species of wheat called emmer, as well as yeast cells and fungus spores. This was the first indication that emmer which, together with barley, was used by the ancient brewers of Egypt and Mesopotamia, also served the medieval Germans in making beer.

THE horn that had been used for mead, a drink made of fermented honey, yielded many pollen grains of flower species visited by bees and even a bee's tongue. In the fermentation of mead, a wild yeast found in flowers was used, and cells of this yeast were abundant in the scrapings from the mead horn. The steins were the horns of European bison, now almost extinct, but abundant in Germany in the Middle Ages.

Using the microscope, the spectroscope, the magnet, and other scientific paraphernalia, including crucibles and retorts, Professor R. W. Wood, metallurgist of Johns Hopkins University, after years of study and experiment, succeeded the other day in penetrating the 3,000-year-old secret of the famous purple gold found in the tomb of King Tut-ankh-amen of Egypt, and in reproducing the alloy in his Baltimore laboratory.

Archeologists were baffled when, ten years ago, there was found in King Tut's tomb a collection of gold head-dress ornaments, sequins and buttons covered with a rose-purplish film, full of curious small bubbles. Some Egyptologists believed that the discoloration of the ages had produced the strange effect. Other scientists were of opinion they were confronted with a lost art of the ancient goldsmith. Professor Wood proved that the latter theory was correct, and that the old Egyptian jewelers had produced the purple sheen by mixing small quantities of iron and yellow arsenic with the gold, heating the mixture and hammering it into shape.

This is the way in which he did it:

After some of King Tut's trinkets had been sent to him for analysis, he found he could remove the purple film by rubbing it with wet finger nail polish.

Placing bits of the polish under his most powerful microscope, Wood failed to find gold in it, but a spectroscope revealed that it contained both gold and iron. He held a magnet near the polish, and it flew from his hands and, adhering to the magnet, confirmed the fact that it had iron in it.

Wood then examined the gold surface from which he had removed the film and found crystals whose microscopic structure indicated the gold had been heated almost red-hot and hammered. These clues enabled him to reproduce the purple gold by making an alloy of gold and iron. But the film he got, though identical in color to that on King Tut's knicknacks, had no bubbles in it.

AGAIN he applied the spectroscope to the ancient film. This time he found traces of arsenic in it. He remembered that the tombs of the Egyptian kings were decorated with orpiment, this is arsenic trisulphide, or yellow arsenic, and sent to Egypt for some orpiment from King Tut's tomb. He mixed the orpiment with a heated mixture of gold and iron and reproduced the bubbles to perfection.

The archeological detective, like the criminologist, constantly appeals to experts in other scientific fields for assistance in solving the riddles of the past. Because the Egyptologist who, not long ago, unearthed a human jaw of about 2,500 B.C., submitted his find to a dental surgeon, we now know that the Egyptians of almost 4,500 years ago had made amazing advances in dental surgery. The jaw showed clear indications of a successful operation on an abscess beneath the lower right first molar!

Dr. Bernhard Wolf Weinberger, of New

York City, the dental surgeon in question, told the meeting of the American Association for the Advancement of Science in Atlantic City last December that not only the ancient Egyptians but the Greeks, the Romans, the Phoenicians, and particularly the Etruscans, between 4,000 and 1,000 B.C., had been dentists of superior knowledge and technique. Gold crowns and bridge work made by the Etruscans, he said, show that they had a thorough grasp of dental mechanics.

Possibly the greatest dentists of all time, Dr. Weinberger declared to the astonishment of his audience, were the South American Indians of about 600 A.D. Not only did they understand the technique of the inlay, introduced by modern dentistry as recently as 1907, for which they used gold, turquoise, and jadeite, but they alone among the ancients knew how to preserve teeth and how to implant and transplant them—an art completely lost to dental science.

It is in deciphering ancient manuscripts and inscriptions on tablets and other stone reliefs that the archeological sleuth is called upon to show his greatest skill and ingenuity and draw upon a vast fund of specialized knowledge as well. Experts of the Metropolitan Museum of Art, in New York, for example, recently translated a single Latin sentence, consisting mostly of abbreviations, into a complete little story of considerable human appeal. The short-hand line, inscribed upon a small marble box read as follows:

C. FABI . C. ET . O . L . FELICIS

And here is how the Metropolitan experts translated the cryptic inscription:

"The ashes of Felix, later known as Caius Fabius, a freed man of Mr. and Mrs. Caius Fabius."

They knew that the letter "L" is the symbol for a freed man, and the capital "C," reversed, the abbreviation for "woman." So it

Electricity Finds Treasure



ARCHEOLOGISTS are now using electric devices capable of detecting underground metal, in order to discover buried treasure. This photo shows one of the latest types that works somewhat like a radio direction finder.

seems that the slave Felix had been presented with his freedom and the family name to boot. He became almost a member of the family, but not quite, for when he died his ashes were not considered worthy of being deposited in the family columbarium (pigeon holes), but were placed in a separate marble box on which his name was inscribed.

THE use of the reversed capital "C" to indicate a woman, has an interesting history of its own. Originally, it was a "G," the initial of "Gaea," the most common woman's name in ancient Rome. Later, this was changed to "Caius" and the symbol, accordingly, became "C." In Rome, a woman often was referred to as "a Caius" just as, in our modern slang, she is sometimes called "a Jane." In Latin, however, there was nothing rough or disrespectful about the term, for in the wedding ceremony, the bride would say: "You will be my Caius; I your Caius."

Neither chemistry, microscopy, metallurgy, nor the arts of the restorer are of much help to the archeological detective unless he possesses the qualities without which no sleuth can hope to solve a mystery—native ingenuity and common sense.

A story a noted archeologist recently told me strikingly illustrates the mental processes of the men through whose detective work the past is recaptured.

Not long ago, a party of tourists inspected the excavation of an ancient town site in Egypt. Aside from the battered wall, built of sun-dried bricks, there was nothing that greatly interested the visitors. One of the party voiced the general disappointment.

"Is that all?" he asked.

This question ruffled the archeologist.

"Yes," he replied, "it is—until you learn to look a little closer. If you can spare a few minutes I will prove to you that some of these bricks can tell a fascinating story."

UPPON a few words in Arabic from the archeologist, one of his native workmen gathered up about a score of the bricks and started off with them at a trot. Then the visitors were invited to follow the scientist to a place about a quarter-mile distant, where the native had spread the bricks upon the ground.

"One morning, about 4,000 years ago," the archeologist told his guests, "a group of laborers were working on this spot, molding bricks of mud and spreading them out to dry in the sun. At noon they stopped and sat down to eat. One of the men had not taken his lunch to the job in a basket, like the others. It was brought to him by his little daughter, a girl of six or seven, who came to the brickyard followed by her pet gazelle. As she entered with the animal, a dog bounded at the gazelle, which jumped out among the newly molded bricks and then stopped short. The dog had put its paws on it. But the little girl was just as quick as the dog. She leaped after it and pulled it off."

The scoffing visitor looked dumbfounded.

"How do you know that?" he asked.

First, the archeologist showed him two brick molds, found in that very spot the day before, showing they actually stood in an ancient brickyard. The bricks fitted the molds. He asked the workmen to turn the bricks he had spread on the ground. Imprinted upon them were three traces of the bare feet of a small girl—one shallow track of a spending foot and two deeper tracks indicating she had been straining at something. Then, there were the four tracks of a standing gazelle. And just behind those were the two tracks of a dog's hindfeet, showing his forefeet were on the gazelle's back. Even that was not all. To the left, on another brick, was one track of the right hindfoot of the same dog, but turned at right angles to the other two—proving the animal had been chased away.

A GRAVE SITUATION

YOU may never stumble over a ghost—but you can't deny that darkness has its very real perils! You never know when you'll need a flashlight . . . perhaps this very night. Keep yours loaded—ready for instant use—with long-life Eveready Flashlight Batteries.

You're sure your flashlight will work when you need it—if it's loaded with Eveready! Because the power-making ingredients in Eveready Batteries have more strength and last longer. Then, too, the all-arounded construction and metal top prevent the power from leaking away when the batteries aren't in use! Fill up your flashlight with long-working Evereadys today. Only 10¢ each. All good stores carry a complete line of Eveready Flashlights and Batteries.



EVEREADY BATTERIES

FLASHLIGHT • RADIO • DRY CELL



EVEREADY BATTERIES are made by National Carbon Company, Inc., the world's largest manufacturers of dry batteries for every purpose. Millions of rural radios are powered by Eveready Layerbilt "B" Batteries and Air Cell "A" Batteries. Eveready Dry Cells serve hundreds of uses in the home and industry. When you need a battery ask for EVEREADY, and be certain of the best that science can build or money can buy. National Carbon Co., Inc., General Offices: New York, N.Y.

Unit of
UCC and Carbon
Corporation

THIS PICTURE FOR FRAMING
A copy of the picture in this advertisement—reproduced in full color—10" by 14"—free of advertising matter, will be sent to you for 10 cents! Mail the coupon or write us today.

NATIONAL CARBON COMPANY, Inc.
Dept. PSM-4-2, 30 E. 42nd Street, New York City

Gentlemen: Please send me a full-color reproduction of the picture "A Grave Situation." I enclose 10 cents (stamps or coins).

Name _____

Address _____



ILLUSION:

The Oriental girl reclines on a sheet of plate glass supported by two slaves. The magician waves a white sheet... pronounces a few magic words... Presto! She has disappeared in thin air.

EXPLANATION:

One of the "slaves" is a hollow dummy. When the magician holds up the sheet the little lady disappears completely—into his empty figure.

IT'S FUN TO BE FOOLED ... IT'S MORE FUN TO KNOW

Here's a trick used in cigarette advertising. It is called "Coolness."

EXPLANATION: Coolness is determined by the speed of burning. Fresh cigarettes, retaining their full moisture, burn more slowly... smoke cooler. Dried-out cigarettes taste hot.

Camels are cooler because they come in the famous air-tight *welded* Humidor Pack... and because they contain *better tobaccos*.

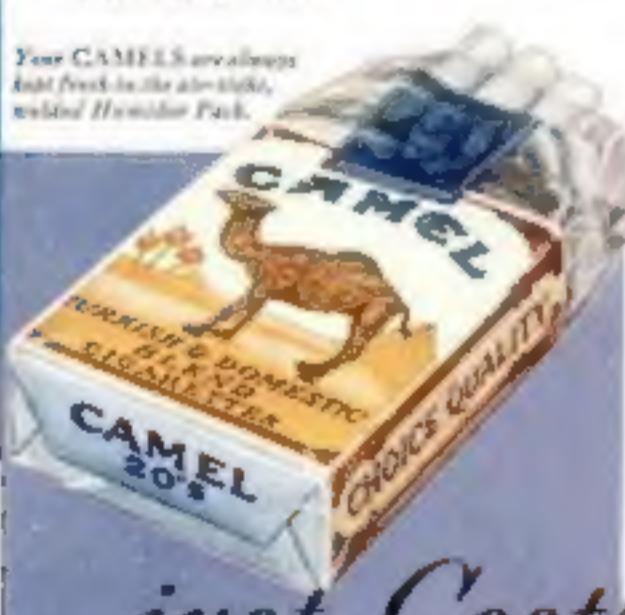
A cigarette blended from choice, ripe tobaccos tastes cooler than one that is harsh and acrid. For coolness, choose a *fresh* cigarette, made from *costlier* tobaccos.

It is a fact, well known by leaf tobacco experts, that Camels are made from finer, MORE EXPENSIVE tobaccos than any other popular brand.

Smoke Camels... give your taste a chance to sense the difference.



Copyright, 1934, R. J. REYNOLDS TOBACCO COMPANY



No Tricks — just Costlier Tobaccos

IN A MATCHLESS BLEND